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FROM PEACE TO WAR, FROM WAR TO VICTORY, FROM VICTORY TO JUST JUDGMENT.

BY PROF. WILLIAM T. SEDGWICK.*

[*Delivered September 11, 1918.*]

Mr. President and Fellow-Members, — When I learned that we were to have a September meeting as usual, and one with a war program, I asked the privilege of coming in and saying a few words — and I will promise not to say many — about the general situation, for it seemed to me that we ought not even to get together without reviewing briefly war conditions and the war outlook. Here we are, plunged into the worst war that the world has ever known, and instead of meeting in our usual peaceful fashion and talking about pipes and piping, about reservoirs and dams, and about water and its quality, we find ourselves discussing shortage of fuel, the building of huge army supply depots and enormous destroyer plants, and asking how long this condition is going to last and what it is all about anyhow. For when we look back a little we remember that only a few years ago we were moving along in a peaceful, happy, contented and prosperous fashion, grumbling of course about many things, — that being the privilege of mankind, — but as we now look back, mostly contented and happy, with the world advancing as we believed toward improved and better conditions; when, all of a sudden, we woke up to find that

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we were in the very midst of something we had read about, heard about, dreamed about, but hadn't believed could ever again possibly be.

I, for example, had gone to Europe in 1914, as I was fond of doing, in that summer vacation which was one of the rewards of the teacher; and my wife and I were in the Pyrenees, that most beautiful mountain range between France and Spain, up in the mountains, not far from Lourdes about which you have all heard, when we picked up the paper one day and found that the Crown Prince Ferdinand of Austria had been assassinated in Serajevo, the capital of Bosnia. It so happened we had been watching Bosnia and the Balkans, for only a few years before we had been in Serajevo and knew the city and had made quite a little study of the Balkan problem, the near East, and all that; so that when, on the 28th of June, we read that the Crown Prince of Austria, the nephew of the old emperor, had been assassinated, we knew that there must be something underneath it. What it was we didn't know; but we did know that Ferdinand was very unpopular with the Austrian nobility, and that he was not at all a favorite with the old emperor whom he was to succeed. We knew that he had been hobnobbing with Emperor William, and as we had known all about Emperor William's intrigues in Turkey and the Balkans for some time, and had been very suspicious of them, we feared that something was brewing which was not for the good of the world. But we didn't know what it was, or how far it would go. So we went on to Paris, and one day in Paris, about a month later, on the 23d of July, we took up a paper and found that Austria had sent to Serbia a vicious ultimatum which could only mean war. This practically accused Serbia, a little country compared with great Austria, of causing the murder of the crown prince, who happened to have been in Bosnia near Serbia and to have been murdered by a Serbian subject. The ultimatum went on to say that Serbia must do this and do that and do the other, and said it in the most peremptory language; so that I at once exclaimed, "This must mean war, because no self-respecting nation can swallow terms like those and live. Her people would upset the government." And then, two days later, as we crossed the Channel, for they only gave them forty-eight hours in which to

decide, to our very great surprise we found that Serbia had eaten dirt, that she had swallowed all of those peremptory demands except one or two, and had promised to consider even those very carefully if she could have a little more time. That meant, of course, that Russia had said to her, "Don't resist, because if you do it will bring on a European war, and we will see you through this thing somehow or other." But it was already perfectly evident that Austria wanted war, and we now know that Germany wanted it and was behind Austria. And, sure enough, three days later war was declared by Austria on Serbia, and within a week the whole thing was going.

Up to this time we had had peace, and then all of a sudden we were plunged into war. I say "we"; and I mean the world. At that time you and I stood off and said, "Well, we don't understand this thing; it is a long way off and we guess it doesn't amount to anything. Probably it is a small affair." And even Great Britain tried to look at it in that way at first. But France knew that it probably meant invasion, and Russia knew it; and, as we now know, the facts were these: On July 5, between the time of the death of the Crown Prince Ferdinand and the ultimatum to Serbia, — and we have the word of our ambassador to Turkey for this, Mr. Morgenthau of New York, — on July 5, Emperor William called together the great men of the German Empire and said, "Are you ready?" And most of them said they were. The Army? Yes. The Navy? Yes. Everybody but the bankers were ready. The bankers said, "We are not quite ready. We want two or three weeks more in order to unload our American securities and gather a little more gold, and then we will be ready." So with that understanding the emperor goes off on a pleasure trip, an alleged pleasure trip, just as a blind, but he doesn't get out of close touch with his people. Mind you, this was on July 5, and on July 23 the ultimatum was sent to Serbia — a little more than two weeks afterwards, the two weeks which the bankers required. And if you will study the reports of the bourses and stock exchanges you will find that during that time there was a very remarkable slump in the stock markets of the world. Nobody then understood just what was going on, or why stocks were being unloaded. But we now know the reason, which was that

German bankers were unloading and getting ready for the 23d of July, when the ultimatum was to be sent by Austria to Serbia. And that is the way we were plunged from peace into hideous, needless war. For it was evidently the design, the malevolent design, of Germany and of Austria, Germany's vassal and tool, to launch a war for domination of the world; and when the day had come, as they decided on July 5 that it had come, it simply had to be. Nobody asks, to-day, who began the war. But why did Germany choose that particular time? We know now. She had been informed by her ambassador in London that the Irish problem was so acute that Great Britain would never think of going into a continental war; that the suffragettes were making so much trouble that Great Britain had all she could attend to at home with them and the Irish question. And I, myself, in Paris, read how in the French Chamber of Deputies it was said, "Our cannon are not right; they are not what they ought to be; we are not prepared for war." They really overstated it, for they were better prepared than they realized, but that statement was unquestionably caught up by the German spies in France and reported at home. And the Germans said, "Great Britain is occupied with Ireland and the suffragettes, and the French cannon are not what they ought to be; and Russia, as everybody knows, has not yet fully recovered from the Japanese war. Now is the time for us to beat the world. Turkey is practically on our side, Austria is always with us, and now is the time for us to do it and do it easily."

We know now all about the beginnings of the war, or at least we know enough so that we have no doubt whatever as to who started it, in spite of all the lies which emanate from Germany about Russia having started it and Great Britain having started it, and no doubt by this time they are saying that America started it. It is easy to say these things, and to say "*Gott strafe England*," "*Gott strafe America*," *Gott strafe* anybody who happens to come along and to get in Germany's way, but the facts are gradually coming out and coming into good shape, so that we know what the truth is. Everybody now knows that for forty years Germany had been planning something of this kind and accumulating vast stores of ammunition and supplies. And why? Was

it because she was poor or oppressed and had to defend herself? By no means. She says she wanted the freedom of the seas, but her ships were on every sea and in every port, and her commerce was flourishing. The words " Made in Germany " were seen on manufactured articles on every hand. Why, then, did Germany begin the war? She began it simply, I believe, because of her easy success in 1870. In 1870 Germany swept through France, captured Paris and wrung from the French people an immense " indemnity " — for what? — for having wronged them. And all these later " indemnities " which she has imposed on Belgium and Serbia and other countries or cities, these are " indemnities " for what? They are indemnities for suffering at the hands of Germany. It is as if a footpad should hold you up on the street, take away your valuables and kick you into the gutter and then say, " Now, my friend, you have got to pay me an indemnity for all this."

We don't like that kind of thing in this country, and we don't think that the world at large likes it, and I don't think it is going to work in the long run. But Germany, finding it an easy matter in 1870 to get from France the money which has since made her rich by enabling her to become a great industrial and manufacturing nation, — for up to 1870 she was largely an agricultural nation and forty years after had become a great manufacturing and commercial nation,— finding, as I say, in 1870, that it was " easy money," that piracy and burglary paid, decided to do it over again, only this time she would try it on the whole world. There is no record in all history, so far as I know, where a prosperous, successful, and happy nation has been so greedy, so full of burglary and piracy and crime and eagerness to rob and plunder her peaceful neighbors. It is unique, except for the Roman Empire, and I believe that in this thing the German nation is emulating the Roman Empire of ancient and unsavory memory.

So Great Britain, France, Belgium, and all the rest were forced into war for self-defense, and we finally joined them, as we ought to have done before we did. And you know what is going on today. You know how over there, on the fair fields of France, our young men are bleeding, not only for you and for me, but for our ideals, for our liberty, for our right to the peaceful pursuit of life

and happiness, and for all the things that you and I most value. And we who are here, — and I have been surprised to see, this afternoon, though I need not have been surprised, how the gray heads predominate over the others — we old men who are left while the young men are on the fields of battle, should not leave a gathering like this without the high resolve that we will do what we can here at home to back these fine young fellows who are giving their lives, and many of them their all, for the benefit of all of us, for you and for me and for civilization and for everything that we have and are and would be. And now through all this struggle there is but one thing that we can stand for, and that is for *victory*. We drifted from peace to war, we are now laboring from war to victory. It is true that we have made magnificent progress. It is true that the German salients are being straightened out, but we are still a long, long way from victory, and nothing less than a pushing on and over the frontier will satisfy us or will bring permanent peace to the world. That day will not come probably this year, — it may, — by good fortune it may, — but General March, our chief of staff, and others who know or ought to know, put it next year, — when the destroyers about which we have heard this afternoon have protected our troop-ships so that millions more than the 1 600 000 who have now embarked shall have gone over to the other side and have taken their places in the battle for liberty and civilization; — when all this has happened, then the gradually exhausted German armies will be driven back over the Rhine upon their own soil and made, I hope, to taste some of those same bitter horrors of war that Germany has imposed upon other nations. And I say this not with any desire for revenge or for cruel reprisal, but simply as a matter of preventive medicine. Germany has got to take her medicine. She has got to learn that this kind of burglary, this kind of buccaneering, does not pay. In 1870 it did seem to pay, although I doubt whether, all things considered, it did pay. If it brought on this war, if it led to this wrongdoing, if it leads, as I believe it will lead, to the downfall of Germany, — then surely it did not pay. But whether it appeared to pay or not, Germany has got to be taught at this time and for all time that such things do not pay; that there is no money and no glory in them, but that even for

her they mean only blood and tears. Not for revenge, not for mere punishment, but that for all time to come the world may be more peaceful, that this kind of embarkation upon world domination may cease; that hereafter a nation may expand through the legitimate channels of trade and influence by even-handed and fair competition, but not with cannon, not with murder, not with submarines to blow to pieces the merchant ships of neutrals. Where is international law to-day? Germany has violated all codes of honor and all international law. She has made herself the great criminal of the age, and she has got to learn that that sort of thing does not pay. For precisely as you lock up a marauder, and precisely as you electrocute a murderer, not for revenge, but to make stealing and murdering unpopular, the German nation must be so punished that she will never again embark on a plundering expedition of this kind, and that other nations, seeing her downfall and punishment, shall be warned against similar excursions. [*Applause.*] Let us turn aside from all who would urge peace by compromise. Let us have no peace negotiated around a table. Let us have first *unconditional surrender* [*loud applause*], and after that *justice* and *judgment.*

Our Massachusetts senior senator, Mr. Lodge, has put it splendidly in a great speech, and while the details of his requirements for peace will doubtless be varied by those who have to do with them, his general principles are perfect. "Belgium must be restored. Alsace-Lorraine must be returned to France, — unconditionally returned, — not merely because sentiment and eternal justice demand it, but because the iron and coal of Lorraine must be forever taken from Germany. *Italia irredenta* — all those areas where the Italian race is predominant, including Trieste, in Austria, must go back to Italy; Serbia and Roumania must be established in their independence and Greece must be secure. Most important of all, if we are to make the world safe in the way we mean it to be safe, the great Slav populations now under the government of Austria — the Jugo-Slavs and the Czecho-Slovaks, who have been used to aid the Germans, whom they loathe — must be established as independent states. The Polish people must have an independent Poland." And so on. I will not stop to read it all, but if any of you want to get the speech

drop Senator Lodge a line and he will send you a copy. I wish you all might read it, because you have in it the whole story from the lips of one of our leading statesmen, a man who, I believe, has great knowledge and great wisdom.

So, then, after victory comes judgment, based upon justice, but seeking the security of the world. Justice and mercy are not the same, and yet perhaps they may be the same; and so you must harden your hearts for the sake of justice and real mercy and must make murder and piracy unpopular for all time to come by carrying this thing through to the bitter end. And it is going to be very real, my friends. The Germans are not going to keep retreating steadily. They are going to *stand*, by and by. But I do believe that, just as surely as the sun rises in the morning, civilization and all who love civilization are bound to triumph in the long run. But it will be a long, long trail, — a long, long, bitter way.

The great danger to-day is that we shall be too good-natured; that we shall say, " Well, after all, isn't it better to stop now and settle it up by a little concession from what would be the right thing? " We must steel our hearts, we must steel our actions against that sort of thing. Justice is a hard word. Justice is the termination, the end of struggle. You and I who deal with groups of men, if we take the right attitude in this matter, may have great influence; so I asked the privilege of coming here this afternoon to say these few words, believing that these words, and others like them, might reach large audiences all through New England.

We are very proud of our Association; we are proud of its past. I, personally, am exceedingly proud of my membership in it and of that high office to which you called me some years ago. I look back upon that with great pleasure. I want to see this Association more than a routine body which goes around like a squirrel in a cage. Each one of its members should stand out in his community for justice and for peace only after unconditional surrender upon the soil of Germany, not outside of Germany, so that she may feel some of those same horrors she has inflicted on other people. Then, I believe, a peaceful era will dawn upon the earth, for it will then have been demonstrated

that piracy does not pay, that the breaking of international law, the wanton burning of peaceful villages, the plundering of men and women and children, and things that we have been used to associate with savagery and barbarism, do not pay; that in the long run comfort and well-being and prosperity and happiness go with the Christian virtues of mercy and justice and pity, upon which the Kaiser and his minions have turned their backs. He is forever prating about God, "*Gott mit uns!*" — their God, the German God. Does he ever mention Christ and the Christian spirit of peace, of love, of mercy, of self-abnegation, self-denial, and all that? Never. It is always the ancient God, the God of battles, the God of hosts. But, my friends, we have got beyond that. We have an ideal to-day which is higher than that, — the ideal of Christianity as well as the ideal of civilization. [*Prolonged applause.*]

THE PRESIDENT. This is a very inspiring conclusion of what has been a very successful session of this war-time meeting of the New England Water Works Association. Professor Sedgwick's outline of the causes that led up to the war and the incidents surrounding the start of the war in the month of July has been very illuminating. I think we can feel the same way about his prediction of victory and judgment to come, — that it is just as well founded as his outline of how the war started. Professor Sedgwick referred to the number of gray heads here this afternoon. There was a time when he was twice as old as I, but the proportion is rapidly decreasing. I used to have a feeling of considerable awe in the presence of Professor Sedgwick; perhaps I may stand in somewhat less awe of him now, but I have no less respect and admiration. [*Applause.*]

MR. CALEB M. SAVILLE. I think the Association owes another debt to Professor Sedgwick, and I think it should give him a vote of thanks for the address he has made to us this afternoon and the thoughts he has left with us. I would make that as a motion.

The motion was adopted by a rising vote, amid great applause.

SAVING OF WATER AND CONSERVATION OF COAL.

BY GEORGE A. CARPENTER.*

[*September 11, 1918.*]

When the writer was notified that the President had appointed him a committee of one to "investigate statistically the relation between the saving of water and the conservation of coal," he began to wonder just what kind of a proposition he was up against.

From his personal experience he was inclined to believe that statistics, as ordinarily compiled, might be used to prove most anything, and was strongly tempted to write and ask the President which side of the proposition he was committed to and wished substantiated.

However, rush of work, lack of assistants in the office, the vacation season, and many other seemingly *legitimate* excuses, all of which might be summed up in one word, procrastination, finally forced the writer to go ahead without compelling the President to disclose his position.

It was quite natural that the writer's first thought should turn to the "Summary of Statistics" adopted in 1902 by this Association for the use of its membership, and he wrote at once to the Secretary asking where these data were filed. Judge of his disappointment when told that this fruitful source of information, provided for just such emergencies as the President sought to meet, had failed to materialize, that only a few were using this form of return, and that very little data of the kind desired were in the files of the Association.

Time was short, there was but one thing for the writer to do and that was to avail himself of statistics compiled by others. He has previously intimated, however, that he has no unshaken belief in the infallibility of statistics as generally compiled. He has been the subject of too many interviews with agents of statisticians, who have generally insisted upon answers to *all* questions propounded on the blank form expected to be filled in, re-

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gardless of the fact that records were not kept in a way that would furnish these data. And when the interviewed expressed his inability to furnish the information desired the interviewer himself has filled the blank by a guess rather than turn the sheet in with some questions unanswered.

Statistics carefully compiled, by one who appreciates what the figures represent, knows how they were obtained and can properly weigh and state their values, may be of great assistance, but figures compiled by one who takes no consideration of how or by whom they were recorded, or what they mean, may be very misleading.

However, in the very general way in which the writer proposes to treat his subject, perhaps figures taken from a report of the Census Bureau may furnish ideas, give food for thought, and lead to a more careful study of the question. At any rate, these were the only figures available in the limited time at the writer's disposal, and he has used them to ascertain where they will lead.

The Report of the United States Census Bureau for 1915 gives statistics of 155 cities which own their own water works. These cities had a total population, in 1915, of a little over 26 millions, and are reported as pumping an average of 3 748 million gallons of water per day, 80 per cent. of which is pumped by steam power.

On the above basis the average, daily, per capita consumption of water pumped by steam is about 114 gal., and for every gallon per capita saved daily there may be expected a daily saving of approximately $14\frac{1}{3}$ tons of coal.

The above figures of coal saved are obtained in the following manner:

The report referred to states that 80 per cent. of the water supplied is pumped, and that 80 per cent. of the pumping is done by steam power. This indicates that 64 per cent. of the total water supplied is pumped by steam power. The report also states that the average horse-power of the pumps, per million gallons capacity, is 36.

Assuming a saving of 64 per cent. of 26 million gallons daily, an average of 36 h.p. per million gallons, equivalent to a head of 207 ft., and a coal consumption of 2 lb. per horse-power-hour, we obtain the $14\frac{1}{3}$ tons used above.

A daily saving of $14\frac{1}{3}$ tons of coal means an annual saving of approximately 5 200 tons, produced by reducing the per capita consumption throughout the country 1 gal. per day, and 52 000 tons per year by a per capita reduction of 10 gal. per day.

Can water consumption throughout the country be reduced 10 gal. per capita per day? Yes, that amount and more too, on the average.

The writer, however, does not believe that this saving should be made by a *uniform reduction* of all consumption, regardless of present rates, for there are many cities that have already reduced water consumption to a very low figure, while others are wasting water in a prodigal manner.

An examination of the tabulated statistics of 148 of the cities reported, representing a total population of 25 644 000, indicates a daily per capita consumption varying from a minimum of 34 gal. per day, for the city of Woonsocket, to a maximum of 324 gal. per day for Buffalo, N. Y.

In 1894, Dexter Brackett, a past president of this Association, made a critical study of the future per capita consumption of the city of Boston for thirty years, and placed the figure at 100 gal. per day.

The latest report of the Metropolitan Water and Sewerage Board shows that the per capita water consumption of Boston and the Metropolitan District rose from about 90 gal. per day in 1894 to nearly 130 gal. per day in 1907, but, with the compulsory use of meters after January 1, 1908, the consumption dropped rapidly to an average of 90 gal. per day in 1917.

Messrs. Hering, Wilson, and Gray based their estimates for water for Philadelphia upon a daily requirement of 150 gal. per capita.

Messrs. Hill, Benzenberg, and Whinery based estimates for Cincinnati on 130 gal. per capita, and Mr. John R. Freeman used 125 gal. per capita per day for New York in 1905, with a legitimate increase of one gallon per day to a per capita consumption of 150 gal. per day in 1930, stating, however, that these figures were made on the basis of "the greatest effort to restrict waste that public sentiment will probably demand or support."

In the report of Committee on Water Consumption Statistics

and Records, made to this Association in 1913, the average daily consumption for 113 cities of the United States is given as 121 gal. per capita; England, 38; France, 54; and Germany, 28.

The average daily per capita consumption for the 30 New England cities listed in the report previously referred to is 82+ gal.

Of the 150 listed in this Census Report of 1915, 55, representing a total population of 4 590 000, now have an average per capita consumption of less than 100 gal. per day; and 88 cities, with a population of 14 546 000, have an average of 125 gal. or less per day.

If we assume that 125 gal. per capita daily is a reasonable allowance, we find that 48 cities could save a total pumpage of 663 million gallons daily, and that of this total Chicago alone could save 37 per cent. by reducing its present consumption of 226 gal. per capita per day to 125 gal. The four cities of Chicago, Philadelphia, Pittsburgh, and Buffalo, with respective averages of 226, 182, 252, and 324 gal. per capita, could save 495 million gallons per day, or nearly 75 per cent. of the total.

If we make the same assumption with respect to the 663 million gallons that could be saved by the 48 cities referred to, — namely, that 80 per cent. of the pumping is by steam power, — we have a total of 530 million gallons pumped by steam; and by applying our previous assumption as to the use of coal to pump this amount of water, we have a possible saving of 458 tons of coal per day, or 32 times as much coal as could be saved if *all cities* reduced the per capita consumption by one gallon per day.

Four hundred and fifty-eight tons daily is about 167 000 tons annually, and Chicago, Philadelphia, Pittsburgh, and Buffalo could save about three quarters of this, or 125 000 tons, by a reduction of the average per capita water consumption to a figure already reached or improved upon by 88 cities out of the 148 cities reported.

If we assume a per capita allowance of only 100 gal. daily, a very much greater saving of coal can be made.

The writer believes, however, that a reduction of consumption to reasonable limits is not the only objective which should be sought in order to obtain a conservation of fuel. Pump slip is

often a source of an enormous waste of power. We often find reports where total consumption, engine duty, etc., are figured to all manner of degrees of precision, only to discover upon critical inspection that all these figures are based upon plunger displacement, with no knowledge of, or attention paid to, the probable slip.

Referring to the figures previously used, 3 748 million gallons pumped daily by 155 cities in this country, and calling 80 per cent. of this pumped by steam, we obtain 3 000 million gallons. If we assume a slip of 5 per cent. only, use our previous figures of 36 h.p. per million gallons, and 2 lb. of coal per horse-power-hour, we find that this slip is equivalent to the wasting of 130 tons of coal per day, or nearly 50 000 tons per year. This is about as much fuel as we found would be saved by reducing the average per capita consumption of the 155 cities previously cited by 10 gal. per day.

And if we stop to consider that in many pumping plants the reducible slip is probably greatly in excess of 5 per cent., we may realize that one profitable field of investigation may lie very close to the pumping station itself.

To assume, however, that a conservation of fuel can be obtained by a *uniform reduction* of the per capita consumption of water throughout the United States, without first giving wide publicity to the wastefulness existing in certain cities, is unfair to those cities and officials now using every effort to keep water consumption within reasonable and proper limits and conserve and increase pump efficiency. It will furnish one more example of the faithful, conscientious citizen, hastening to do his bit and carrying also the additional burden caused by the thoughtless extravagance and wastefulness of those who will not or do not care.

Never before in the history of the world has the absolute dependence of one nation upon another, one community upon another community, and one individual upon another individual, been recognized to the extent that it is to-day. This world-war has brought home to thinking minds a realization of individual responsibility, of the necessity of unity of purpose and of individual sacrifice for the common good, that could have been produced in no other way.

To-day, therefore, is an opportune time to bring to the attention of those cities, where prodigal use of water amounts almost to a crime, the fact that such wastefulness is far-reaching, that its effect extends beyond the borders of the city itself and may reach even across the seas, tending to withhold from those brave men upon whom civilization now depends for its existence, the arms, ammunition, and supplies needed in its defense.

PRACTICAL METHODS FOR DETECTING LEAKS IN UNDERGROUND PIPES.

BY DAVID A. HEFFERNAN.*

[*September 12, 1918.*]

The unparalleled severity of the past winter, with all its attending evils, seemed especially applied toward water works, and makes timely a discourse on this subject. There is no question but that, in the memory of any of us here present, the past winter has never been surpassed in its destructive aggressiveness, at least, since water-works systems became a fact and not a theory.

The unprecedented depth which the frost reached was the cause of more leaks in two months than the average superintendent would have to combat in a year. The ravages of the cold touched with ill effect most every sort of installation or appliance used in connection with the business, affecting the ball-cock in the tank in the private home on one extreme and the hydrant in the street on the other. It may, therefore, be safely said that, in addition to showing an extraordinary jump in cost of maintenance, water-works reports for 1918 will also show a large increase in the number of leaks. Even though the cold spell ended five months ago, all its effects have not yet been felt. So that while this little paper is not intended as an authoritative essay it may be that a few helpful hints will be gleaned from it.

It is estimated that the daily per capita consumption of the Metropolitan Water Distribution System, as included in Boston and vicinity, is about 16 per cent. higher than last year. A part of this may be accounted for in the increased use due to work pertinent to the war, as especially applied to Quincy and Watertown. But the remainder must be held to be an after result of the winter.

In February, the average increase for the district was 29 per cent., in four different cities and towns reaching 135 per cent.,

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129 per cent., 125 per cent., and 104 per cent. Of course, this was due to running water from inside taps to prevent the possibility of services freezing, and should not be considered as waste water in its narrower sense as applied to leaks. The present high consumption, though a result of the winter, is waste, pure and simple. It is a matter of patriotism for every superintendent to use every means at his disposal to combat the wasteful and needless use of water.

It has been calculated that if the waste water be eliminated from our systems, 150 000 tons of coal would be saved yearly in New England alone. And it must, by this time, have become apparent to us all that if New England does not extricate herself from the position in which she was found last winter the Fuel Administration will not. So it simply devolves upon us here to help in its accomplishment. The efforts of the superintendent should be largely centered on the endeavor to better his system by minor improvements. The war has restricted building, and in some places completely abolished it. As the necessity for the extension of mains is entirely dependent on new building operations, if building has stopped, the money and labor hitherto used in construction can be better applied in the improvement of the system; and there is no water-works plant so near perfection that extensive improvements cannot be made. One of the most satisfactory ways of employing this energy is by reducing the waste of water. The responsibility for this waste water lies in two places, with the consumer and distributor. The distributor has or should have the knowledge of how to correct the evil, and also the ability to impart this knowledge to the consumer. To educate the consumer to the point where he realizes that it is for his own benefit to stop the use of water beyond the amount actually consumed for useful purposes should be the duty of the distributor. I think all are familiar with the recognized methods. Press articles bring good results, and mailed or distributed circulars, with plate showing various-sized openings, with the amount of water each would permit the escape of and the cost of these amounts of water in tables, are satisfactory agents.

In conjunction with a campaign of this sort, it is well to have inspectors make a house-to-house canvass, looking for defective

plumbing. It should be explained to consumers receiving water by meter that it is much cheaper to pay plumber's bills than to pay for water from which he has received no benefit. In the case of a flat-rate service, the threat of cutting off his supply, if repairs are not made, is effective. The inspector should be equipped with an aquaphone, and, as he visits each house, should listen on the pipe in the cellar for a leak on the service. In this manner, a quantity of small leaks will be discovered and repaired.

The distribution system presents a different problem. The simplest method of detecting leaks is by means of daily consumption comparisons. This presupposes the fact that there is some means of measuring the amount of water supplied to the distributing mains. This measurement may be made by computing the flow over a weir, by piston displacement of pumping engines, or by the actual measurement by Venturi or other meter. If by the second method, careful allowance should be made for slippage.

In the consumption book, daily records should be kept of the amount supplied to the mains. With this should be kept the relative conditions that might cause a variance in consumption, such as conditions of weather, fires and their duration, blowing-off operations, and leaks discovered. With these facts at hand, it is possible to estimate fairly accurately the cause of any sudden increase in consumption. For instance, Monday usage, as a general thing, will be larger than any other day of the week because it is the customary wash day. A day on which a large fire occurs will show an increase. Opening a number of hydrants on dead ends for the purpose of clearing the mains will show an excess, as will a prolonged spell of dry, hot weather. So that, if a sudden increase in the use of water occurs with none of these factors entering, it is a safe wager that a leak or leaks exist in the system. If the measuring device has a self-registering attachment, to watch the night-flow (between 1 and 4 A.M.), it will give indications of the condition of the system.

After the fact of the presence of a leak has been established, it is next in order to find it and make the necessary repairs. There are several methods for its discovery. The old-fashioned test-pit scheme is as good as any, provided the system is well equipped with

valves. The test-pit is nothing more than a manhole of convenient size, built around a gate. On either side of the gate and within the manhole a tap is made and corporation inserted. This furnishes the foundation for a by-pass around the gate. In the by-pass a meter is set, its size dependent on the consumption of the district to be tested. If the section is a large one, necessitating larger than a 2-in. meter, it is well to make a supplementary by-pass with small meter around the larger one. The section to be tested should be carefully laid out, all gates located beforehand to eliminate delay, and tested for tightness. The test for a leaky gate is simple. Close the gates to be tested and open a hydrant on the line between, removing the suction cap. Then open one valve slightly until the water in the hydrant barrel rises to the level of the suction nozzle and just flows out. Then close the valve again. If the water continues to flow from the nozzle, one of the valves must be leaking. Of course, for a few minutes, the flow might be from the houses in the district, but this should stop shortly. If the level of the water lowers, it shows a leak somewhere in the cut-off section, below the level of the hydrant nozzle; but it would indicate a good-sized leak, as the open hydrant removes all pressure from the line. Aquaphones may be used on each gate, as further tests of tightness. The best hours for the actual testing are from 1 to 4 A.M., when the flow is less than at any other period of the twenty-four hours.

If all the gates are tight, it is evident that no water can enter the section so cut off unless it passes through the meter on the by-pass. If readings of the meter are taken at set intervals, and gate by gate the area of the section covered by each test-pit lessened, it can be seen with ease that the leak will be discovered to be between a certain pair of valves. After its general location has been determined in this manner, the exact point where the water is escaping can be determined by looking for any luxuriant growth of vegetation at the side of the road, by dampness on the surface of the street, by driving down a bar and noticing any moisture on removing it, by means of an instrument magnifying the hissing sound of escaping water or by using any other convenient method. In this manner, a whole city or town may be covered.

The instrument just mentioned is contained in a small, light box. A small four-leg brass table is set on the ground over the pipe in the vicinity of where the leak is supposed to be. The box has a raised bottom, so that it may be placed over the table to keep out foreign noises. On the table is a microphone-detector with wire connection to an amplifier battery contained in the box. Very sensitive ear receivers are wired to the battery. When the instrument transmits a rushing noise to the ears, it is evidence that the leak is close at hand. The affair is set at different points along the pipe line until the point where the noise is loudest is reached. The leak will be found directly under this spot. Used in connection with a wireless pipe locator it will be found to be satisfactory.

The beauty of the test-pit scheme is that it is permanent; the pits are always ready in time of need. If it is not desired to construct the manholes, the same results may be obtained by connecting two hydrants with fire hose, one hydrant being inside and the other outside the district to be tested.

Another method, quite as accurate, but probably more complicated and requiring more delicate apparatus, is the use of the Pitometer. There are also several special methods. One was described before a meeting here some years ago, by F. J. Hoxie, called the "caustic soda method." Another is a special device making use of water hammer. It works on the principle that the sudden closing of a valve produces an impulse which travels through the water in a wave, decreasing in intensity in passing an opening in the pipe. It is claimed that the relative distances from the instrument to the break and to the suddenly closed valve is readily determined, but with what accuracy I cannot say.

From our experience in Milton, we believe the test-pit method to be as accurate as any, and simpler than most. It proved its value this spring when we found our daily consumption, which had been away above normal all winter on account of water being run to prevent services freezing, was not at all reduced when mild weather set in. We were using at the rate of 500 000 gal. daily, which was 56 per cent. above normal. The leak was discovered in short order, the average daily consumption reduced 180 000 gal., and the night flow reduced from 20 gal. to 10.

DISCUSSION.

THE PRESIDENT. The paper is now open for discussion. It presents a fruitful source of work and inquiry.

There is one thing that I have been impressed with in the discovery of underground leaks, and that is the necessity of having a particular crew of men educated to do the work. I find all the difference in the world between an experienced crew and one that is not experienced. And I find that certain men can be developed by sort of an instinct inherent in them to find underground leaks, having a better sense of that work than other men who are apparently just as capable. Possibly one illustration may show that difference in the characteristics. We had a leak in Philadelphia, on Chestnut Street, that showed water in the cellar of one of the banks not far from Broad Street. It existed there for weeks. We sent three or four different sets of men, and nobody could discover where it was. We had conclusive reports, apparently, that it did not come from the city water, and yet the leak persisted. We could not find any leaks in the sewer pipes; the drainage seemed to be complete. And finally it was found to originate from an old wooden water pipe that had been out of commission for over a hundred years but had been left in the ground. There was a stretch of 300 or 400 ft. of this old wooden pipe which terminated near the bank building, where the water was found in the cellar. And the drainage from the building where this pipe started had been run by some malicious plumber into the open end of this old wooden pipe. In coming out of the building he had found the open end of this pipe and thought it was more convenient to attach to it than to go into the sewer, so he turned his drainage into this pipe and let it run where it would. It ran 300 or 400 ft. through this old wooden pipe and got into the bank cellar. Of course the water bureau was blamed because the water came from a water pipe, even though it originated with a sewer pipe. It was a case of the sins of the fathers being visited upon the children because they failed to take that pipe out, and even though sewage had been put into it the water works was blamed.

MR. J. M. DIVEN.* In Troy leaks frequently occur in old, abandoned services. The old services are shut off at the curb

* Superintendent, Water Works, Troy, N. Y.

and the frost gets into them there. The cold weather causes quite a number of leaks of that kind.

Mr. Heffernan. I should like to hear from any superintendents who have had experience with either the pipe locator or leak detector. On the whole, I have had pretty good luck. The first day I had the instrument I discovered a leak in a private service, 300 or 400 ft. long. The soil was of a gravelly nature, and the leak did not show on the surface. After determining the line of the pipe with the locator, we followed it along with the leak detector. I indicated to the laborer the spot where I believed the leak to be. When dug, the leak was found to be directly under the spot I marked.

Mr. George F. Merrill.* We have had very good success with the detectaphone, and also by driving a bar through the paving or macadam, down to the pipe, so that we could get a contact and could follow a leak up very closely. This is simply an instrument carried in a box having a small dry battery, and works on the principle of a submarine valve. It magnifies the sound very greatly. If you lay an ordinary watch on a table, this machine will pick up the tick or the vibration of the tick on an ordinary table eight feet long and detect a vibration.

Mr. Diven. Has Mr. Heffernan or any one else had experience where water from leaky mains was carried in a duct to a considerable distance, finding an opening there?

Mr. A. E. Martin.† There is a question we are interested in at Springfield. It is not more than a month ago that the railroad people notified us that there was water in their manholes in a certain street. We investigated it, and followed that water back more than a half mile to a place where there were four branches — the main pipe branches each side and then in a little way there are two branches off one of the side connections, and we suspected the leak must be in that region. The only way we could detect it was by the rod which Mr. Heffernan spoke about, — driving it down through the paving and finding the wet spot. We thought we had discovered it, and it finally proved that we had, but we had to shut eight gates around that leak before we could repair

* Superintendent, Water Works, Greenfield, Mass.
† Superintendent, Water Works, Springfield, Mass.

it. I think the rod has proven the most satisfactory of anything we have, to detect leaks. We use the detectaphone a great deal and have the aquaphone, too, but have used the detectaphone more. When leaks are reported we go into the ground with this rod, and ninety-nine times out of one hundred succeed in finding them. This leak proved to be right in the branch, and while there was no special sound — the leak apparently was such that it could not be detected by sound — but knowing it might be there we drove the rod down and found the wet spot. In digging for it there were two ducts, one branching out of the other at a very acute angle, and we had to go down between the ducts and come in under to the side of it. The duct was about five feet wide. And just at the further edge of it we found the leak in a T in the main pipe. It was some little job, being in clay soil, and took about twenty-four hours to dig it up after we found it. So our experience has been more in favor of driving the rod, — the divining rod you might call it, — to find the leak after we have cornered it with the detectaphone.

MR. WILLIAM NAYLOR.* I have just received one of these locators, and tried it on the street where I suspected there was a leak. The funny thing was that it seemed to indicate a leak all along that street. I was wondering if Mr. Heffernan could tell me why I got sound all along the street. There was one peculiar thing about that leak. The pipe runs through a brook, and I have no doubt the water in the brook was running over the pipe and making more or less noise on it. Whether or not that would cause that sound all along the street, I would like to know.

MR. HEFFERNAN. I think that is probably what the trouble was. In order to use the machine successfully, you must have a very quiet day, with little wind. Of course it is a pretty delicate affair. Everything must be favorable and very quiet, or you will get foreign noises. I wrote to the manufacturers about a case in Dedham but could not get a satisfactory reply from them.

MR. NAYLOR. How far, in your experience, could you find a leak with this locator?

MR. HEFFERNAN. I have tested out 400 or 500 ft.

MR. NAYLOR. How far could you hear?

* Superintendent, Water Works, Maynard, Mass.

MR. HEFFERNAN. I could hear it practically the whole length of the service.

THE PRESIDENT. Mr. Heffernan, do you find any difference in the hearing of different people? Do you find that one man can hear better than another?

MR. HEFFERNAN. Oh, yes. On this machine I would have probably three men listen. I think my hearing is pretty good, so that I generally depend upon my own hearing to make the sounding.

THE PRESIDENT. That has been my experience. Personally I can't tell a leak from anything else.

MR. GEORGE E. GORNLEY.* We had an 8-in. main going through a large stream from a pond. We knew there was a leak in the hydrant below, and put the machine on and about a dozen different ones tried it. After we had repaired the leak at the hydrant we got the same effect. Then we went to work and put in a cofferdam and held back the water, and had no sound from that. We have had very good luck with the machine out our way. We found one very bad leak in the main. It was on the side of the main, and the water ran about 300 ft. before it showed. There was a very excessive flow of water there. Some days it would go 250 000 gal. above normal. It was necessary that something be done, and all hands started in, so that we were able to find a great many leaks. We have two of those detectors, and had got down very close to normal conditions by the first of September. Now we are having a great deal of trouble with our services, and found a leak this morning, which showed up about 80 ft. from where the leak occurred.

MR. H. D. GEDLEY.† Sometimes, I think, the fault is with the machine. In my case the first time I tried to use the pipe locator I thought I was getting results all right, and all of a sudden I could get no sound. I let one of the other men try it and he couldn't get results. Finally, after trying a long time, we got the agent who sold us the pipe locator, who was very sure the trouble was that we didn't know how to use it. We let him try it and he couldn't make it work any better than we did. Come to find out,

* Water Commissioner, Abington, Mass.

† Superintendent, Fairhaven Water Company, Mass.

there was a broken connection in the ear-piece, and when that was connected it worked all right. The fault was with the instrument.

MR. SAMUEL A. AGNEW.* While I have not had this new detector, I have received a great many advertisements of it. I have looked with longing eyes at the instrument, wondering whether it would do what they said it would. I have had the old detector and I have always had the aquaphone. Now, most of the leaks that I am troubled with are on the beaches. My experience with the detectaphone is that I can hear the waves rolling up on the shore; and personally I am like Mr. Davis, — I am no good on the job at all. My son seems to be more successful in finding leaks, but in his experience he always found the aquaphone better than the detectaphone. Why, I do not know, except he would always go back to the old aquaphone. The method we use almost invariably is to go along the street and open the service boxes. It is quite a job, to be sure, — especially when you find the service boxes full of sand. But we listen as we go along the street at the various service boxes, and in that way we can ordinarily determine somewhat the locality of the leaks. I am pleased to know that the new leak finder is successful. I don't know whether it is new or not; it is advertised quite widely at the present time. I have not bought one, as I wanted to know something from others' practical experience before I invested. While the detectaphone was supposed to be better than the old aquaphone, we did not seem to get as good results from it as we did from the aquaphone, — possibly because it magnified the sounds that we did not want to hear. We have always used the aquaphone and with very good results.

MR. GIFFORD.† I should like to mention cement-lined pipe in connection with the pipe detector. I have had a little experience and should like to hear from others in regard to the use of the pipe locator on cement-lined mains, — not services.

MR. MARTIN. I can't tell anything about a pipe *locator*, but I *can* tell about trying to thaw out frozen service pipes. In any cement-lined main we have in Springfield, if you attempt to thaw it with electricity you will get stung. You might as well not try.

* Superintendent, Water Works, Scituate, Mass.
† Superintendent, Water Works, Dedham, Mass.

While once in a while you may find a joint in it which will carry the current through, the next one won't, and you will not get by. We tried one of the new leak finders and had the same experience that this gentleman had with the detectaphone, — that it amplified sounds that we did not want to hear, and the consequence was that we couldn't make the thing work as well as the aquaphone and the detectaphone. We corner the leaks as well as we can in the way he speaks of, — by listening in service boxes and gate boxes along the line. In that way follow it to a point where we think it probably is, then we try the rod and generally find the leak.

Mr. Gifford. My experience with the pipe locator on cement-lined mains is that while I swore by the pipe locator before, that day I swore at it. I had a leak on the line and wanted to locate it. One of my men told me the location of it but I did not agree with him. I put the pipe locator on, and located the pipe on the other side of the street. The man swore it was not there, and I told him I was sure it was there, that the machine could not be wrong. They dug down there and found a gas main. The next day I went into two houses and found both houses were connected up with Ruud gas heaters, and the current had evidently passed around through the iron pipe and located the gas services rather than the water pipe.

Mr. Agnew. I had a very bad leak. We finally determined that it was around a certain gate, but could not find it. We dug pit-holes and drove down a bar, and did everything we could think of. Finally we dug around the gate and put in a meter, but it did not show any leak at all. We could hear the singing very plainly. We went up the line, which, after leaving the beach stones, went through a heavy clay or sand, and did not seem to hear the sound as plainly, but it certainly was not beyond the gate, because the meter would have shown it. The first thought was that the gate was not releasing itself, because we have heard where water, instead of passing through the meter, went through a leaky gate. It was not there. Finally we went back up the line, probably two hundred feet, and found an old connection which had been used years ago for filling a standpipe and that old pipe had broken off. Now, that was a very baffling thing to us,

and the trouble was that a couple of weeks before we really located the leak way up the line and all sounds indicated it was beyond the gate.

FREDERIC I. WINSLOW.* The paper and discussion suggest a paraphrase of Kipling, "There are forty ways to find a leak, and every one is right." I call to mind three distinct leak cases on the Boston water system some years ago. The first was one of considerably over one million gallons per day, and indicated that a gate had been left open between the high and low service. On careful investigation, however, no such gate could be found, and as all these gates were carefully recorded and were comparatively few in number, it was not a difficult matter to settle the question. Meantime the leak continued, and it was finally decided to use the Deacon meter system, a part of which was still in use in that part of the city. It so happened that this section was so situated that it could be shut entirely off without interfering with the flow to other portions of the city. Section after section was shut off at night until the search was narrowed down to a very few blocks, when, as one of the workmen stepped on a blow-off gate, he felt a quivering of the cover. It was speedily opened, and the gate was found to have been left open and was discharging into a sewer.

The second case was on a large main which was noticed to slowly empty when the gates feeding it were shut and an air-cock opened. As there were no immediate takers on this line it was decided to cut it and connect the two capped ends with a small lead pipe and meter. This showed on which side the leak was; then that section was cut in two and the action repeated. In digging just beyond the limits of this work, a cock was found in the ground and a corresponding hole in the pipe, so that this leak had in all probability been in action for many years.

The third case was where a leak appeared in various cellars some weeks after a pipe near by had been re-laid. A number of tests were made, involving shutting off all the mains in the vicinity at night, but the leaks continued until damages for a ruined house were sought.

Finally, after every cellar in the vicinity had been re-examined, save one which never could be opened, and nothing found, it

* Consulting Engineer, Boston, Mass.

was determined to enter this particular cellar; and it was then found to be the only cellar in the neighborhood completely filled with water, and, as this cellar was beside the re-laid main, it was decided to pump it out, when there was found an open end of a pipe which a foreman had carelessly connected or re-connected to the new main, forgetting that it was shut when he found it on the old main.

It must not be forgotten that the stopping of all waste of water, while always an important problem, has now become doubly so, and it is not improbable that if the various municipalities do not at once move in this matter, and it is very certain that not all will do so, the matter will be taken up and enforced by either the state or the national Government, to the end that fuel may be conserved.

THE FUEL SITUATION IN NEW ENGLAND.

BY PROF. IRA A. HOLLIS.*

[*September 11, 1918.*]

PRESIDENT DAVIS. Mr. Storrow, the New England representative of the Fuel Administrator, has gone to Washington. That means that New England will get more than its share of coal, and will receive coal which was destined for other parts of the country. [*Laughter.*] That is the reputation that the New England Fuel Administrator and his associates have in other than the New England States. We outside of New England can only hope that Mr. Storrow will soon represent the water works, irrespective of locality. Mr. Storrow has asked Prof. Ira A. Hollis, whom we may say is one of us, the engineer in this state for the Fuel Administrator, to come here, and he will tell us of the fuel situation in New England. I have the pleasure of introducing Professor Hollis.

PROFESSOR HOLLIS. *Mr. President and Gentlemen,* — I am quite sure that Mr. Storrow regrets very much that he had to go to Philadelphia yesterday afternoon and subsequently to Washington on the fuel business. I do not agree that every time he goes to Washington there is an increased allotment of coal for New England. It is like the swing of a pendulum, — sometimes there is a decreased allotment and sometimes an increased. His visits to Washington are usually consequent upon a decrease which has been made in his absence, and he hastens to Washington to get our allotment restored.

He was to speak here on the fuel situation in New England. Of course, when you take the word "fuel" technically, it means anything that will produce heat when combined with the oxygen of the air; but we are far more concerned with one kind of fuel than we are with all kinds, and it is the coal situation in New England that is important to us. People have said to me, as I

* President of Worcester Polytechnic Institute and Engineer for Fuel Administration of New England.

have gone about the state, " Why not cut a lot of wood to replace coal? " Did any one of you ever make an estimate as to how much wood would have to be cut in New England in order to replace the coal that this part of the country receives in the course of a year? It would be 60 million cords. I think that would supply a pretty large army in France. We cannot afford to cut wood in any such quantities as that to replace coal. We can afford to cut it only as a form of insurance to tide us over those periods when there is an interruption in the flow of coal to this part of the country. So I shall confine my remarks, excepting in brief part, to the subject of coal.

One thing I have observed in going about the state, — and I have been to all parts of the state during the past two months, speaking to manufacturers, to fuel committees, and, in fact, to anybody who would listen, on the subject of conservation and how to reduce the demands for coal in this state, — and that is the fact that there has been a steadily growing optimism on the subject of the supply of coal. Only last night I was talking to a large body of men in Holyoke, and a gentlemen said to me, " Well, I suppose we have plenty of coal now, because the Fuel Committee finds it difficult to procure purchasers for the coal that comes in." We have an excellent example of that in Worcester, because fifteen carloads of coal came into Worcester the other day in box cars, and actually they couldn't find any place to deliver it except to one company which carried it into its own yard and thus provided itself with an entire year's supply. One of the principal problems, however, has related to getting labor to unload the coal. That kind of a phenomenon has given rise to the belief that we have gone over the top with regard to the supply of fuel for the coming year; and my object in coming here this afternoon was to answer the question I have heard so often put throughout the state, " Have we got by the difficulties of the coal situation in New England? "

I want to say here emphatically that we have not gotten by the difficulties; that there is the same hazard with regard to the future that there was two months ago. A recent order issued by the Fuel Administration in Washington has covered up the real facts of the case, despite the fact that we need more and more

coal all the time. I am going now to try to state just exactly why it is that there appears to be plenty of coal, and then to state why it is that we haven't it.

There are two aspects of the coal supply. One of them is the mining of the coal itself. Mr. Garfield and others who have investigated the subject say that there will be no difficulty in getting plenty at the mines. I cannot say as to the correctness of that statement, because there is fluctuation from pessimism to optimism in Washington. One week there is plenty of coal and the next week there isn't. I do believe, however, that there is sufficient evidence to warrant the statement that the amount mined this year will exceed that mined last year by, perhaps, 80 million tons. But the demand for coal in the manufacture of everything that goes to supply those sons of ours on the other side, and to the making of an effective army, exceeds the increase in the amount of coal mined and available at the mines, so that, instead of coming out ahead of the game this year, we are behind, and will have less coal than we actually need, unless by some method we can cut down by our savings the amount demanded. The supply from the mines, then, is supposed to be reasonably certain.

Another aspect of the coal situation relates to its distribution. I heard a lecture before the United States Chamber of Commerce, about three months ago, on conservation, and I afterwards told the gentleman who delivered the lecture that he had balled the thing up entirely, in treating conservation as if it meant elimination of industries and a saving of coal in that way. That is not saving coal at all; that is destroying industries, which is far from being the same thing as decreasing the demand for fuel. I divide the subject, first, into the mining of coal and, next, into this question of distribution, and it is in the distribution that the chief difficulty lies here in New England.

At the risk of boring you, perhaps, to extinction, by telling you what you already know, I will say just a word about how the coal comes into New England. It is estimated that 30 million tons will be needed to get us through the winter, — I am speaking of all New England, now. About 10 million tons of that comes through what are known as the gateways, and 20 million tons come from tide-water. That means that 10 millions can be hauled

in by rail and that 20 millions, to make up the 30 millions, must come by water from Norfolk and the other places down the coast, to which the coal is delivered from the mines.

Now, the amount of tonnage required to haul in this coal from tide-water, or to move it, is in the neighborhood of 400 000 tons. That is, if all the barges and ships made one voyage from tide-water ports to Boston, where the bulk of the coal is delivered, they would deliver 400 000 tons of coal. When you consider that they are going to bring 20 million tons, and that it takes 400 000 tons of shipping constantly on the move, without any interruptions at all, to bring in that amount for us during the year, you can realize that there is a considerable amount of shipping that must be plying the ocean along our coast to keep New England supplied.

The year for the coal supply begins on April 1, and not on January 1, and on April 1 there was a great shortage of shipping required to bring the coal in. The tonnage has been steadily increasing, however, until on July 1 there was something like 400 000 tons of shipping available, and at the end of this last month, August 31, there was roughly 500 000 tons — about 480 000 tons — of shipping, thus assuring us sufficient tonnage to haul in our coal. It has been discovered, however, in the last week, that the regular supply of coal to New England has been seriously interrupted at tide-water by the fact that coal has been diverted to another section, and that we have had a lot of ships down at Norfolk eating their heads off, simply waiting there, with no coal to haul. Mr. Storrow, with great good sense and good judgment, has told the Government that he would rather surrender those ships and have them doing some war work than have them waiting there until the flow to New England can be resumed, and so he has surrendered 100 000 tons of shipping, thus leaving us now with about 375 000 tons when the flow begins once more.

There is another subject to which I would like to call your attention. A good many comparisons have been made between the year 1917 and the year 1918. It is impossible to make a satisfactory comparison between them because in the former year there was a great amount of coal in storage. I have heard it estimated that there were 9 million tons in New England; and the falling off in the supply of coal to New England caused by divert-

ing coal elsewhere was not then a serious objection, as we could draw on our reserves. That is exactly what we did last year, and we got through very comfortably, or reasonably comfortably, because we were drawing on our reserves. I cannot say as to the truth of this statement, but I have understood that the investigation of the Fuel Administration has shown that the reserves were exhausted by the first of April this year, so that we had to start anew without any reserves. That means that the delivery of coal in 1918 must be far greater than in 1917, even to bring us up to what we had in 1917, so the statistics of the relative amount hauled in 1917 and 1918 are very misleading. I speak of that because I have a sheet here showing just how much coal has been hauled in every month, and I want you to see exactly where we stand in this business.

I want to say, however, that I am not speaking of this in criticism of the Administration, because we know perfectly well that to change a great country like ours from a condition of peace to that of war has necessarily made a serious disarrangement of everything. I have criticized the Administration many times for being too slow, yet God knows that in some respects they have accomplished a miracle. I do not speak of their cutting off the supply of coal in criticism at all, but I am merely reciting it as one of the facts of the case, so that we may understand the necessity for us to cut down our demand for coal as much as possible, and in that way help our great country at this time.

It was the judgment of the Administration that the best way of getting this coal into New England was to make speedy use of the summer months, when there would be no interruption on account of ice and not likely to be bad weather. So it was agreed to supply New England from the first of April for six months thereafter at the rate of 3 million tons a month, with the expectation that during the next six months the coal would come in at the rate of 2 million tons a month, recognizing the delays and detentions that would arise on account of cold weather. Consequently, in judging as to our supply at the present time and its relative sufficiency, it is not right to compare 1918 with 1917, but we ought to compare what has been delivered with that which we are going to need when the time comes. The criticism I started to make a

moment ago was of the fact that the Fuel Administration advised everybody in New England to lay in their supply as speedily as possible, while the going was good. They have advised people to do that all over the country, and especially in New England, because the haul here is seven hundred miles, far greater than to most of the other places which are supplied with coal west of the Hudson River by rail; and by water it is still greater. They advised us, and wisely, I think, to lay in our coal supply. But after having done that, a few days ago they issued orders limiting the amount that one could have on hand in storage. You can imagine the position of a company in Worcester, for instance, — and I am stating an actual case, — that obeyed the request of the Fuel Administration and laid in enough coal to last them for four months. They had one hundred and twenty days ahead. Now comes out the order, about fifteen days ago, saying that war industries may have a storage of coal for only sixty days, and non-war industries a storage of for not over thirty days. In other words, all those people who have laid in and have in stock more than enough to last the sixty days have got to wait before they can get any more coal. It doesn't make any difference how the coal is coming in, we have got to find some way to dam the flow and, perhaps, damn the order for the position it has put us in, because we had previously been urged to put in our full supply and now find ourselves cut down to sixty days' reserve. That is why thousands of tons of coal come into our cities, and appear to go begging. It is because people are not allowed to have it.

Now, when you think that we want to bring in 3 million tons a month in order that we may have something in reserve when cold weather comes, so that the detentions from ice and storms may not deprive us of coal in the winter when we can get only 2 million tons a month, when we receive an order that limits the supply so that we are certain to suffer in the winter whether we like it or not, it gives us some anxiety that ordinary people who know nothing about the coal situation do not have. They see great piles of coal in the city and can hardly realize that there is a shortage.

Here are the actual statistics. In 1917 the amount of steaming coal which was hauled in by the end of August over the railroads

and brought by water was 11 122 000 tons. At that time there was probably 8 or 9 million tons in storage. The amount hauled in in 1918 up to the same date, during the five months, was 13 000 000 tons. That is estimated, but probably it is right, inasmuch as the complete data could not be brought up to date quickly enough to give us the latest information. That, gentlemen, is an apparent gain of 2 million tons of coal. But is it a real gain in the supply of New England, when you consider that the reserves are burned up? Far from it. On August 31 of this year there should have arrived in New England, in order that we might have coal to take care of us this winter, 15 million tons, which is 2 million more tons than actually arrived. In other words, we have 2 million more tons than we had last year, but we are still 2 million tons short of what we ought to have. I don't know what ultimate effect this order about the sixty-day reserve is going to have, but this represents the bituminous coal situation at present.

Now, as to anthracite, what is the situation? The data in regard to that I cannot bring up to date, but I can give you some idea, up to the end of July, anyway. Our limitation now is two thirds of the amount of coal we had last year. On that basis we are all right up to the present time; we are getting in about the amount of coal we ought to have. The amount actually brought in is 4 550 000 tons at the end of July. I cannot give you the statistics at the end of August, but I think we have the amount required in accordance with the two-thirds schedule. The required supply is 4 600 000 tons, so we are pretty nearly up to it. I am inclined to think that before the winter is out the anthracite in a good many of our homes is going to be pieced out with the bituminous coal, as was done last winter to some extent. But I have been trying to spread this gospel through the state, namely, that the cutting of wood and the purchase of a couple of cords of wood is a wise insurance against our situation later. Furthermore, it is a certain measure of economy in getting us through the chilly days of the fall and spring without burning coal when wood is a little more economical, perhaps, than coal, if we use it wisely. My advice throughout the state in regard to this coal situation has been that every family who can afford it ought to have in the cellar a couple of cords of wood. I heard an old Irish-

man who lives near me say the other day, "If I only had a pig hanging in the cellar, and some heads of cabbage and potatoes, I shouldn't care for anything." I have been preaching the gospel of two cords of wood, and I think that gospel ought to be spread.

That is all I have to say on the subject of distribution, gentlemen. Because, after all, the problem of New England, and the thing which makes it peculiar and different from any other portion of the country, and the thing to pound into the Administration in Washington, is the fact that New England is remote from the coal fields; the haul is anywhere from 300 to 700 miles greater than to any other part of the country east of the Mississippi, and that is what makes it a great problem. That is why they advise us to use anthracite screenings, because the anthracite is closer to New England than the bituminous coal. And there again you run across some very curious things in connection with distribution of anthracite. Some of my friends in Holyoke, having been strongly urged to use anthracite screenings as a method of saving bituminous coal and reducing the haulage, so that the cars could be moved more rapidly, changed their station over into one which would burn anthracite screenings entirely. After they had got well started they received a new interpretation of the regulation which put the sizes of anthracite screenings that they were using into the domestic class, and they can't get any of it now. I presume that will straighten itself out, however, after a time.

Now, the next thing I want to say relates to another side of the fuel situation. How can we manage to live on the coal that will be given to us? How can we trim ourselves down to the minimum in New England? I might say, by organization, putting into every factory its own fuel committee made up of its own employees, and trying to create that moral attitude of mind toward saving which would cut out every unnecessary electric light and save every bit of fuel; and I think there is, perhaps, a reformation taking place in the state along that line. I see it everywhere. I have been to every city in the state to speak on the subject of how to reduce the demand for fuel. And there, again, gentlemen, there is a confusion in the minds of the Administration as well as in the minds of the engineers. Conservation means the saving of waste,

the more efficient use of the heat that is produced by the combustion of fuel. We cannot use that word as synonymous with the elimination or shutting off of industries. If we shut off an industry it will come again, and we want it to come again. That is not conservation at all. It is merely reducing the demand so we can get through the year or get through the war without suffering. Another thing that is wrongly considered as conservation is providing substitutes for coal. But that is not conservation at all. To cut a cord of wood to replace coal reduces the demand for coal in New England and helps us through the war, but it is not conservation. The use of water-power, the use of gasoline or petroleum, is providing a substitute. It may be a long-time substitute, and we may find after a while that we can provide enough substitutes to save a lot more of the patrimony which God has given us in America to be handed over to our children.

Conservation I take to mean a reduction in the amount of waste, and, in order to accomplish that, we as engineers — I mean by "we," Charles T. Main, and Safford up at Lowell, and Joe Skinner at Holyoke, and Gilmore at Fall River — have agreed to serve with the Administration as an Advisory Board on the subject of saving. We have gotten out two or three pamphlets, — "bulletins," as we call them. They are nothing great, because we have tackled the thing entirely from the common-sense standpoint. We felt that it would be foolish for us to go into the industries in this state and insist on their making great changes at the present time. In the first place, they couldn't get the machinery with which to do it; and, in the second place, there isn't time to do it. What we have done is to make the attempt to have every industrial plant and factory in this state inspected, with the hope that we could assist, through the organization of committees of their own and by advice, in reducing the amount of coal used with the machinery already installed.

And I want to say to you, gentlemen, that as engineers it is sometimes humiliating to think how wasteful this nation has been, and to think also how in some respects we ourselves have fallen down as engineers. I have one case in mind at the present time. When we began last December, I talked to the manager of a certain concern on the subject of waste. He appointed a com-

mittee of five, representing the different departments of the factory, — there are twenty acres of floor space, — and they went ahead and studied the question of waste in their plant, not by calling in a consulting engineer at all, but simply by going at the matter as a plain, common-sense proposition. They had weekly meetings for conference and to decide what would be done the next week. Last December they used in that factory 950 000 lb. of coal. They worked steadily at eliminating waste through the factory, not in the combustion of the coal, — they made very, very little change in the fire room, and they covered some of the piping, — but by studying the actual use of the power after it got out of the engine room, and of the steam after it got away from the fire room, throughout the factory; and they gradually reduced the amount of fuel used, so that in March, which was a month in which the temperature was very nearly the same as it was in December, they had reduced the consumption of coal from 950 000 lb. to 550 000, — a saving of 200 tons a month. What does that mean, gentlemen? I told their manager, that instead of being commended for that great saving which he had effected I thought it was the saddest confession I had ever heard. They had been going on in that way for years, with that great waste. And there isn't a manufacturing concern in this state where conditions cannot be improved. I can state case after case where such waste has taken place, and mainly outside of the fire room, in the mill and manufacturing departments. And what we are trying to do in this state is to stop that waste.

I have congratulated myself on having Mr. Main backing and helping in this matter. He has been a power for good in the state. I told him if we went about together he could preach coal and I would preach sermons, and I thought we could reform the state. We have been welcomed everywhere, and every engineer I have run across has been anxious to do something. Because, what does it mean — whether there is going to be any shortage in Massachusetts or not — what does it mean to the other side if we can save coal here? Does any one in this room realize that the wounded men in the northern part of Italy last winter had to lie cold in the hospitals? They hadn't any coal to use, and we had no ships in which we could send it to them,

and, if we had had, the submarine menace was too great. So the poor fellows coming back from the battlefield wounded had to lie down in freezing rooms. Does any one realize the tremendous amount of coal which is required to supply our soldiers on the other side, and that every pound of coal we save in this state by true conservation — that is, by the elimination of waste in our factories, and I will say in our water works, too, — means a more successful army on the other side?

There is one thing which always comes into my mind when I consider this subject. After all, if we are going to enable our industries to get through the winter by decreasing the demand for coal, if we are going to keep our children warm this coming winter and supply our soldiers on the other side with what they need, it must be because we have a will to do it. Throughout the country people are too careless. I think there is a higher conscience in Massachusetts. I am not a Massachusetts man; I am a Kentuckian; but I have observed one thing which makes me glad to live in this state and to be an adopted son, and that is that there is a high conscience here in regard to anything of this kind. But until our whole people realize that it is upon us that our boys on the other side must depend, we shall not have the will to exert our whole power in taking care of them.

It has been said by the President of the United States that we have gone into this to make the world safe for democracy. It has been said that food will win this war, and that fuel will win this war. What will win the war, gentlemen? What will make the world safe for democracy? It is the blood of our own boys, our own sons, whom we have sent across the seas. It is not food. It is their blood flowing into the fields of France that will make this world safe for democracy. That is the point after all. Sometimes I wonder if we have made a good bargain. I wonder if we are going to bring as many of them back home as it will be possible to bring back. I know that we are going to be victorious. God has written that in the sky, — that right must triumph over might. Nevertheless, are we going to win our victory with as little loss as could be suffered? I fear not, because we are not in that state of mind yet where each one feels that he himself must make a contribution and that it is his duty to think of that contribution.

I have one last word to say in this connection. It is not on the fuel situation strictly, and yet I believe it to be a part of it, because it is the moral aspect of this thing that we must get into our minds if we are to do all we can in saving all that can possibly be saved. That is the psychology of this whole situation. I sometimes wonder what my own boy will say to me when he comes back. I was just saying to Mr. Davis that I had a letter from him yesterday morning, and in it he told how he was pushed off to the side of the road when the 101st Engineers came by, and how he remained at the side of the road until a whole American Division of 15 000 men had passed and 800 motor trucks, rushing up to the battlefield.

What are they going to say to us when they come back? Can we face them fairly with the conscience that we have done our share even in a little thing like the saving of coal? I want to see that great review in Washington, which is going to be spread through the country in the "Movies," when the boys come back. I want to see them, and I know in my heart they will all be there. Every one of them will be there, some in uniform but others in spirit, whose mortal bodies are lying in the soil of France. They will all be there, some seen only through the tears of sorrow, but they will all be there. Shall we have kept the faith? Shall we have done all that we ought to have done in every respect to make the fuel situation safe for them, to make it safe for our children, and bring as many of them home as we can? God help us if we haven't done that, for if we have not we shall never be happy again after they come home.

Thank you very much. [*Prolonged applause.*]

Discussion.

The President. We are greatly indebted to Professor Hollis for coming here. He certainly has stated the fuel conservation situation in a most thrilling and vivid manner, and brought it home to us in such a personal way that we will never forget it, and will carry the message from this meeting to our own communities, as it will be carried through the publication of the Journal to a large circle of readers.

This telegram comes from Mr. Edward E. Minor, of New Haven. It says:

"Priority list just published places water works in second class. Water supply, so fundamentally necessary for all human activities, should be in first class. A deferred classification may result in our being unable to obtain coal or other essential material. Request action by the Society asking Priority Committee for re-classification water works in their list. New England water works supply greatest arsenals in the country."

The question is, whether there is any possibility of water works going without fuel because they are in Class 2 instead of in Class 1. Perhaps Professor Hollis can answer that question.

PROFESSOR HOLLIS. I don't know. I do know this much, that any one who wastes water at this time is pretty nearly a traitor to the country. I don't believe in cutting down the water supply of the family to any particular amount. We all want to take care of our children and make of them good citizens. I remember hearing a man saying in a public address that we must give our all, but I don't believe in that. A man should not give his wife nor should he give his children to be public charges. That would be the destruction of civilization. A concession ought to be made to the family before everything else, because the family, after all, is the foundation on which the state is built up. I doubt if it is right to classify water works in the second class, and I don't believe that will remain very long. I don't think you need give yourselves any uneasiness about that, because as soon as there is any little shortage of water they will restore the thing. I shall be glad to answer any question on the subjects I have touched upon.

MR. J. M. DIVEN. I suppose it is possible to save considerable coal in the homes. Has anything been done in the way of education in that direction?

PROFESSOR HOLLIS. Yes. I will say this to you, gentlemen. I was very much pleased, the other day, when an old friend of this Association, not a member but a member of the Boston Society of Engineers, came to my office in the State House and said to me: "I don't feel that I am doing all that I ought to do. I want to do something more." "What do you want to do?" I asked. "Well," he said, "I am retired now; I am on a Carnegie pension, but I am still vigorous and I should like to go about this state telling

the people how to use coal in the kitchen and in the furnace. I should like to organize something on that line, and I am perfectly willing to address every women's association in the state." I asked him to go down and introduce himself to Mrs. Thayer, who is at the head of the women's organization. She has been communicating with the chairwomen of the various women's organizations in the state, and this man is now about to start out and go into every city and put into the households methods by which the people may be made more comfortable in their homes when it is cold. I was charmed with his enthusiasm and his desire to help. That was Prof. C. Frank Allen, formerly professor of engineering at the Massachusetts Institute of Technology. [*Applause.*]

THE FUEL SITUATION IN NEW ENGLAND, AND NECESSITY OF CAREFUL PLANNING IN ORDER TO GET THROUGH THE YEAR ON A RESTRICTED AMOUNT.

BY CHARLES T. MAIN.*

[*September 12, 1918.*]

The United States Fuel Administrator estimates total coal demand for year beginning April 1, 1918, at 735 000 000 tons bituminous and anthracite; this is 84 000 000 tons more than was produced last year, and the Fuel Administration does not expect that the increase can be fully met. Fuel Administrator says that 60 000 000 tons must be saved to avert disaster.

Reasons for Shortage.

The principal reason for this shortage is that there is not sufficient transportation facilities for hauling enough coal and all the raw materials, food, and other things needed. Primarily, there is not a coal shortage, but a transportation shortage. The railroads must be given all the coal they can handle now. There will be less room for it later.

Another reason is because of the great increase in coal consumption. This increase began before we were in the war. Since we entered, the pace has increased, and it will continue to do so. New war industrial plants are springing up in great numbers. Some of these are colossal; single plants are calling for from one to three million tons of coal a year.

Curtailment will be necessary in many things which have been regarded as necessary. Everybody is going to feel the pinch. Industries must be readjusted. Dislocations and troubles are inevitable all along the line. It is our task to help reduce these to a minimum.

* Civil Engineer, Boston, Mass.; member of Advisory Committee, Fuel Administration of Massachusetts.

Estimates for New England.

The estimate of the New England Fuel Administration for bituminous coal for 1918 was 33 400 000 tons.

The estimate of the United States Fuel Administration is 30 000 000 tons, or 10 per cent. less than the New England Administration.

Recently the United States Fuel Administration has proposed further curtailments to 25 000 000 tons, on the ground that the estimates of the New England Fuel Administration have been excessive.

Assuming 30 000 000 to be enough, the amount which the railroads can haul is limited to about 10 000 000 tons, leaving 20 000 000 tons to come by water transportation.

The estimated amount of tonnage required for the 20 000 000 tons is approximately 500 000, assuming perfect service, — no allowances made for accidents, wrecks, strikes, difficulties in procuring seamen, and hostile attacks by submarines.

On January 1, 1918, there were only 200 000 tons available, the reason being that the vessels were needed for transportation of men and materials to Europe. The full tonnage required was reached after eight months of the year had expired. It does not require any complicated figuring to see that the 30 000 000 tons will not be delivered.

The reserve storage of last year was all exhausted during the winter, so that we started worse off than usual.

At this time of year, when considerable coal has been stored, to the casual observer it may appear that there is an immense amount on hand and enough to last all winter. As a matter of fact, sixty days' supply is the maximum allowed at present.

Probable Deficit.

The indications are that New England will get pretty near its usual supply of anthracite, but that there will be a deficit of at least 6 000 000 tons of bituminous coal, or at least 20 per cent. less than the United States Fuel Administration's estimate and 30 per cent. less than the New England Fuel Administration's estimate.

Effect of Shortage.

This country is engaged in the most stupendous undertaking that any country ever undertook. Some of our citizens do not comprehend this yet. Dr. Hollis says it is not a war to make democracy safe, but a war to preserve the Ten Commandments.

In order to win the war, it is necessary for us to operate our manufacturing plants to the maximum capacity to supply the supplies and munitions which are required in such vast amounts to back up our soldiers and sailors who are standing between us and ruin.

The industries cannot be run full unless there is sufficient power to run them. This power can be supplied from four sources, — coal, oil, wood, and water-power. Of these, coal is the chief supply.

How to Get Along with Less Coal.

There are about three ways to get along with less coal.

1. By eliminating and shutting down what may be called the less essential industries — and who shall determine what are less essential? The shutting down of any industry will cause hardship on the owner, employees, and the community in which it is located.

The United States Government has now, through the War Industries Board, established a branch called the Production and Conversion Section, the duties of which are to convert plants the products of which are not essential to the war, so that they will run on war work, thus showing the necessity of using all of our facilities.

The shutting down of any industries is the last thing that should be resorted to.

2. The next way that suggests itself is in the use of substitutes for coal. Considerable oil fuel is now used with satisfaction in New England; but this again is a transportation problem, and the fuel oil companies will not take any more contracts so long as the conditions are as at present.

Considerable quantities of wood have been cut within truck hauling distance in some towns and cities. The local fuel committees are strongly urged to encourage the early cutting of wood

in their districts, so that it can become dry for use in the winter, dry wood being of considerable more heating value than green wood.

Hydro-electric power can be substituted with advantage and saving of coal in some instances, but the hydro-electric companies in this state hesitate or refuse now to take on additional business, as their plants are fully loaded.

Steam-electric power might be substituted in some instances in plants using relatively small amounts of power, and where there is no use for exhaust steam, or in summer time when there is no heating.

The great bulk of the water-power plants in New England have old and inefficient wheels, in poor settings, and of a capacity to use all the water in the stream for about six to seven months in an average year. Many of these could be improved and increased in capacity in a reasonably short time, so as to get the benefit of the improvements before the time of stress is over.

3. The third method of getting along with less coal, and the one that we are most interested in at present, is to study and analyze the various possible losses and reduce these to a minimum.

The people of this country are a wasteful people in many ways, in the use of hot water, in the waste of cold water, in the consumption of foodstuffs, in our clothing, with our automobiles and in our processes of manufacturing; and it is a pity that we should have waited until the stress of war should have caused us to give some heed to these wastes.

Cost of Power.

In nearly all lines of manufacturing the cost of power has been such a small per centum of the value of the output that it has received secondary or no consideration in many plants.

In electric light and power plants which sell current, the whole cost of the current is the value of the product, and of this approximately 60 per cent. is coal. The same conditions prevail in pumping stations, where the full product is water pumped. In most of these plants records of operation are kept and an endeavor made to keep up the efficiency of the plant.

Plan Suggested.

The plan which the local fuel committees are requested to inaugurate is the setting up in each manufacturing establishment, where fuel is consumed, a fuel committee of its own employees, whose duty it shall be to see that the coal is consumed economically and power is produced economically, and that there shall be no waste of steam and power throughout the plant.

The numbers and character of the committee would vary with the size of plant and kind of work done, and it can be assisted by as many persons as seems desirable.

Advisory Engineering Committee.

An Advisory Engineering Committee has been appointed by the Fuel Administration for the purpose of assisting the local fuel committees in the various towns and cities in getting these plant fuel committees organized and started, and the engineering committee will enlist the services of other consulting engineers to give general advice where needed. These engineers, however, cannot be expected to make exhaustive studies and reports without pay.

The Advisory Engineering Committee has prepared a pamphlet in which is pointed out the many places where wastage may occur, with suggestions to prevent these wastes. It has also outlined the method of organizing the plant fuel committee and suggested the duties of the members.

It has also suggested forms for records of performance and accomplishment.

As this work must be very general in its nature, and will not be applicable to every plant, variations should be made from the suggestions to suit the local conditions.

What are the Remedies?

In order to avert disaster during the coming winter, there must be accomplished at least three things:

1. A better organization of the transportation facilities which we have. There is little chance for further improvement of these facilities, for the railroads are under physical limitations

of car production, and the shipping facilities are most urgently needed for transportation of men and supplies to Europe. The only hope of avoiding another serious coal situation next winter is along immediate action along the other two lines.

2. The second is the more careful preparation of coal for shipment in order that heat-producing coal shall be delivered and not incombustible material. It is stated that 72 000 000 tons more coal was shipped last year than would have been required with coal of an average quality. *This is one of the causes of the transportation difficulty last year.*

I have been informed that the Government has placed inspectors at the mines, to prevent a repetition of this.

We have no control over 1 or 2, and must therefore devote our attention to the third remedy:

3. Economy in the use of coal, and prevention of waste in the use of power and steam.

"It is . . . important to impress upon the manager of every industrial enterprise that it is his personal duty to see that his plant gets just as much out of the coal it buys as is humanly possible.

"It is up to every one of us, whether we are manufacturers, professional men, coal operators or dealers, to immediately take stock of the situation and turn energetically to the problem in hand, — the problem of shaping the habits of the future so as to avoid the sad experience and mistakes of the past."

Fuel and Power Committee for Water Works.

You may say that the plan of a "fuel and power committee" which is being established in the manufacturing plants is not applicable to pumping stations, and that you have always endeavored to run at the maximum efficiency. This same statement is made by some of the manufacturers, but there is no plant which is one hundred per cent. efficient, and in many plants which have been considered as remarkably good there have been made considerable reductions in coal consumption.

You may also say that you will obtain all the coal you need to run, as it is absolutely necessary that the water supply be not shut off. This is true, but every pound of coal that can be saved

will be so much more available for use elsewhere and will help in stabilizing manufacturing which is vital to the country at this time. There is also the incidental saving in cost of operation, which is worth consideration with the present high fuel prices.

An extra effort should be made at this time to prevent wastage of water by leakage and in the houses and elsewhere.

Every water-works plant using fuel or purchased power might form a "fuel and power committee" on similar lines to those established in manufacturing plants, the personnel and duties of which are outlined in the attached diagram; the size and scope of work to vary with the size of the plant.

Extracts from Bulletin No. 1 of the Advisory Engineering Committee.

(Some of these have been slightly changed to suit water-works practice.)

Methods for Saving Coal — Detailed Suggestions.

In the Boiler Room.

Make a record of observations. Boiler efficiency cannot be increased without knowledge of what is being done. In order to figure the evaporation (pounds of water evaporated per pound of coal) the following data are needed:

Weight of coal; also per cent. of ash.

Weight of feed water pumped.

Boiler pressure (also temperature of steam if superheated).

Temperature of the feed water at its source and entering the boilers.

Temperature of the flue gases after passing through boiler or economizer.

Percentage of carbonic acid in the flue gas, if possible. This item is a good index of the amount of heat wasted in the gases sent up the chimney, due to incomplete combustion.

Number of heat units in a pound of coal ought to be known, but in this emergency it will hardly be feasible to have tests made except in very large plants.

Stop up cracks and joints in the boiler settings, to prevent air leakage inward or outward. Air also leaks through porous brick. This can be prevented by a coating of sizing followed by one or two of whitewash.

Keep tubes and flues free from soot, and do not use scale-producing feed water. Both soot and scale reduce the efficiency of the boiler.

Keep blow-off and other valves packed, and repair leaky joints without delay.

Avoid blowing down of boilers and blowing of safety valves oftener than necessary.

DAILY BOILER ROOM RECORD.

.....COMPANY. DATE.....19.....

Time.	TEMPERATURES.					Boiler Pressure.	Per cent. CO_2.	DRAFT (INS. WATER).				Feed Water Meter Readings.	Boilers Running.	Boilers Banked.	Remarks.
	Outdoors.	Water at Source.	Water entering Boilers.	Flue Gas.	Steam if Superheated.										

NOTE. — Time (first column) is arranged to fit each plant.

MEN ON DUTY	First Watch	Second Watch	Third Watch

Coal burned (pounds)			
Ashes (pounds)			
Feed water (pounds)			
Tubes cleaned (number of boiler)			
Fires cleaned (number of boiler)			

NOTE. — This is to serve merely as a suggestion. Each plant requires a special form to fit local conditions.

Form No. 60D.

.....PUMPING STATION, ENGINEER'S HOURLY RECORD.....

Engine No..... {STARTED,.....} {REV.....} .....
{STOPPED,.....} {GALS.....}

Hour. 7 A.M.	Counter.	Revolutions.	Gages.						Temperatures.			
			Heads.				Steam.		Vacuum.	Condenser Inlet.	Condenser. Outlet.	Heaters.	
			Force Main.		Suction Main.		At Throttle.	Receiver.	Condenser.				
			Feet.		Feet.		Lbs.	Lbs.	Ins.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
8 A.M.													
9 "													
10 "													
11 "													
12 M.													
1 P.M.													
2 "													
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4 "													
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1 A.M.													
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3 "													
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5 "													
6 "													
7 "													

CYLINDER OIL, GALS.....
ENGINE " " .....
GREASE, LBS.....
WASTE, " .....

LIGHTING DYNAMO STARTED.....
DYNAMO STOPPED,.....
AMPERES,.....

MAIN.

Have all pipes containing steam or hot water properly covered to prevent radiation.

Return the condensation from heating system so as to raise the feed water to the highest possible temperature. Formerly engineers were reluctant to return to the boilers any condensation from exhaust steam of engines because the oil it contained was bad for the boilers. Practice is changing, however, due to desire for greater efficiency and improved devices for removing oil. Get good advice on this point. Oily drips are not returned, of course.

Employ the best firemen obtainable. This is the most important element in boiler-room economy.

It should be remembered that a large percentage of the heat of soft coal is contained in the volatile matters, that is, the gases. To save this heat from going up the chimney a method of firing must be adopted which will distill these gases, that is, drive them off as in a gas retort, and burn them before the fixed carbon in the solid coal is burned.

One way of doing this is by the so-called "coking" method of throwing the fresh coal upon the dead plate, and letting the gases be driven off and burned by the heat from the glowing coals at the rear. Later this charge is pushed back and a new lot takes its place. The difficulty with this is the liability of stirring up the fuel bed, which should be avoided.

Another way to get the same result is by the so-called "side firing" method of firing alternate fire doors, the gases from the fresh coal on one side of the grate being distilled and burned by the glowing coal on the other.

In any case it is essential to spread the coal in small quantities frequently rather than large lots at longer intervals. Keep the fuel bed even and not too thick (say six to ten inches).

Watch for thin spots and keep them filled, as a hole in the fuel bed allows an inrush of too much air.

Do not disturb the fuel bed too often.

Keep ash-pit doors open and regulate draft by dampers.

Do not let glowing coals accumulate in the ash pit, as they promote clinkering by keeping ashes on the grate too hot. As a further precaution against clinkering keep water in the ash pit if possible.

Draft equipment, whether natural or mechanical, should be sufficient to supply the required amount to support combustion. It is frequently found that extra boilers are added unnecessarily when a slight improvement of the draft conditions would have sufficed.

In the Engine Room.

Keep a record of engine, turbine, and generator performance, and power and pumping data.

Watch the atmospheric exhaust head for wasting steam. If it appears at regular intervals investigate the demands for power and see if the load can be reduced at such times.

Study the "auxiliaries," — feed pumps, blowers, circulating pumps, deep-well pumps, stoker engines, etc. These are usually very wasteful of steam, and can be allowed only in case their exhaust is all used all the time. If this is not the case, overhaul and repair them, or substitute motor drive where practicable.

On reciprocating steam engines take indicator cards often, reset valves, examine piston rings to avoid leakage of steam by the piston.

Examine the drip system for blowing traps.

Where there are no recording instruments, plot on cross-section paper a curve showing hourly changes of power load for a typical day once a month. Great losses are found at times of light load. Equalize the load, if possible.

In certain plants savings can be effected by turning low-pressure steam back into receivers for use in the low-pressure part of engines and turbines, to produce more power; in others, by the method of "bleeding" low-pressure steam from the receivers of compound engines or from the later stages of turbines. This steam, after generating some power, is discharged at a pressure slightly above atmospheric, and used for heating, the remaining steam going away through to the condenser. The best method for a particular plant can be determined only by a competent engineer after careful analysis of existing conditions.

It should here be pointed out, however, that the efficiency of any steam engine or turbine (except very large units) does not exceed 20 per cent. in a plant producing power only. But if the steam is first used for power and later for heat, the steam efficiency may approach 100 per cent. Hence see that the utmost use is made of exhaust instead of live steam in heating feed water and buildings, and for any other purpose requiring low-pressure steam.

In general, where buildings can be heated with exhaust steam, it is not economical to send steam from the engine to the condenser and use live steam for heating.

In the Heating of Rooms.

It is always right to use exhaust steam for heating buildings and water. Consequently, time should be taken this summer to modify existing plants in order that exhaust steam may be used. In doing this, straighten out the returns to avoid water pockets and give them a good pitch. No steam should be allowed to waste through the steam traps, which should be placed in locations where they can be seen at all times.

All windows and doors should be made and kept tight.

Install thermometers and a simple system of reports of temperature. In many rooms, the heat generated by friction of the machinery is sufficient to raise the temperature considerably, so that a regular system should be adopted of shutting off the heat soon after work is started, instead of opening windows. Except in rooms where special processes require a higher temperature, 65 degrees is adequate. Begin to standardize your room temperatures early in the fall. Do not wait and lower it suddenly when the colder weather comes.

In the Lighting System.

Shut off every unnecessary lamp and reduce size of lamps where possible without loss of good service.

Little more need be said on this subject, as attention has been called to the advisability of redistributing the lamps in accordance with the need. It is inexcusable to put a high-power lamp where a low-power lamp will answer, and no company is justified in permitting a bad system to continue.

Modify switching system to give better subdivision, so as to light only the parts of rooms being used.

Substitute tungsten lamps for carbon lamps.

Bulletin No. 3.

Bulletin No. 3 has been prepared by the operating engineers and firemen, copies of which are here for distribution.

Small Sizes of Anthracite Coal.

The Fuel Administrator desires that, where possible, anthracite screenings be used. This request is due to the fact that this coal can be shipped into New England easier than bituminous coal and not because of any other advantage in the use of screenings.

The thermal value of anthracite screenings varies from 9 000 to 13 000 B.t.u. per pound.

With a good natural draft, about twenty-five per cent. of this coal can be burned without affecting the boiler output. To burn a larger percentage, artificial draft is required, and grates with smaller air spaces will be required to prevent the sifting of the coal into ash pit. Screenings have been used successfully as high as eighty per cent.

Records.

Referring to record of observation, "Weight of Feed Water Pumped," the pounds of water evaporated by each boiler should be kept for each watch or shift, as well as the total amount in pumping stations of considerable size.

This can be done by installing Bailey boiler meters on each boiler. These instruments indicate and record the output of steam from each boiler, also the rate of air supply to the furnace and condition of fuel bed, all three on the same chart.

FUEL AND POWER COMMITTEE — ORGANIZATION CHART.

CHIEF ENGINEER. GENERATION OF STEAM AND POWER.	CHAIRMAN OF WATER BOARD. CHAIRMAN.	SUPERINTENDENT. DISTRIBUTION.
Duty.	*Duty.*	*Duty.*
Make a list of power plant apparatus, stating general dimensions and commercial rating of boilers, engines, heaters, draft control, etc.	Call monthly meetings and keep records of same.	Systematic plans of distributing system.
Systematize drawings of plant and piping systems, so that committee meetings may not be delayed for want of information. Add notes showing sewer connections, and every place where water or steam is thrown away.	Publish decisions of committee in their name on bulletin board in station and elsewhere, if desirable.	Systematize records of users so that excessive use may be checked.
Make list of meters, indicating and recording instruments, etc., now installed in station and others necessary.	Compile records of savings made.	Call attention of committee to any seeming excessive use by any consumer.
	Approve recommendations for changes and appropriations.	If possible, check amount pumped with amount accounted for as used, in order to detect any large leakage in distributing system.
	Confer with chairmen of fuel and power committees in same town and with local fuel administrators.	*Committee of Registrators.* Coöperate with superintendent in keeping records and checking waste.

Begin daily boiler- and engine-room logs, if not already in use. Form depends on individual plant. See pages 238 and 239.

Report to committee every month the principal quantities, such as, daily coal burned, feed water pumped, evaporation (pounds of water per pound of coal), feed-water temperature, per cent. of ash, output, etc.

Report apparatus or repairs most needed to improve efficiency.

Organize subcommittee of firemen, preferably one from each watch.

Committee of Firemen.

Coöperate with chief engineer in finding and keeping up best method of firing.

Report general quality of each lot of coal as to moisture, clinkering, etc.

Report cracks in boiler setting, leaking valves, etc.

The chart will show which boiler produces the most steam, also which fireman produces the best results. It will show the fireman when the fire in the furnace is in the proper condition to produce the best combustion.

It is not possible to increase the apparent evaporation of the boiler by opening the blow-off valves, as only steam evaporated and passing out the boiler steam pipe is recorded.

Discussion.

The President. Mr. Main's paper is now open for discussion. There is one point I should like to speak of first, and that is the matter not only of the quality of the fuel but a continuation of the same kind of fuel. In our pumping stations we have been seriously handicapped recently from the fact that coal has come in from a comparatively limitless number of mines. One particular station might have coal from one district one week and from another district next week; or perhaps two or three districts at the same time. There is a great deal of difference, of course, in the firing methods which must be applied to get the best results from different qualities of fuel. A fireman will be accustomed to one method, and the Fuel Administration finds it necessary to send him coal, from another district, of a different characteristic. He no sooner gets accustomed to that than another kind of coal comes in and forestalls the condition of economy we are trying to attain. We had an illustration in Philadelphia of what we might call rivalry of emulation — the benefit which has come from that. We have one pumping station which is a fairly good one, and when the Fuel Administration sent out word that their engineering force was to investigate all the plants, to mark us up and grade us, and being supposed to tell us whether they could or couldn't do better, I thought I would forestall them and send them first to a plant which was a very good one, and keep them away from the others which I was more or less ashamed of. They adopted the suggestion and went to the best plant first, and gave us a rating of 96 out of a possible 100, which happened to be the highest of any plant in Pennsylvania. That had good results. When all the other pumping stations learned that that one station

got a rating of 96, they all got busy and wanted to have 96. That shows the benefit of good-natured rivalry. Another point I want to touch on a little later is the labor situation, on which I wanted to air some of my troubles. Mr. Main suggested one of the most important things is a good fireman. We probably have all had the experience that no sooner do we get a good fireman nowadays than somebody else takes him at higher pay.

MR. J. M. DIVEN.* In the discussion of this boiler-room practice, a man suggested that the fireman should be a higher class and higher paid man than the engineer. I have had good luck with firemen on the bonus plan, giving the crew that pumped the most water, or the same amount of water with a less consumption of coal, a bonus. This created a good-natured rivalry among the firemen. The results were excellent, and effected a considerable saving in coal all along the line.

MR. FRANK L. FULLER.† The coal we get for home use is certainly poor enough. It seems to me a pity to ship coal from Pennsylvania that absolutely will not burn. I do not quite understand why some action has not been taken in regard to it. It seems to me it is a decided waste to send coal that will not burn — it is only a waste of transportation charges to do so.

MR. DIVEN. The reason for the poor quality of the coal has been explained to me by coal operators to be the impossibility of getting the pickers at the mines. They are substituting girls for the men who did the picking, and they have not done the work satisfactorily.

THE PRESIDENT. We had some illustrations of poor coal that almost would not burn, and we were told not to unload it until some representative of the Fuel Administration came out and saw it, to see whether we would or would not pay for it. But we had to unload it, as it was all the coal there was. And finally when we put in the claim for rebate it seems that one of the patriotic coal miners had given up his coal-mining business and had gone into the Fuel Administration, and this particular coal came from his old mine, in which, I presume, he still had an interest. It was pretty hard to get a rebate on that coal.

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* Superintendent, Water Works, Troy, N. Y.

† Civil Engineer, Boston, Mass.

MR. DIVEN. You should have a B.t.u. contract.

THE PRESIDENT. All contracts have gone. Anything that is black goes nowadays. I had wanted to say one more thing: Mr. Main spoke about burning anthracite screenings. We are burning No. 3 Buck, so-called, and are trying to burn No. 4 Buck, but have not quite succeeded in that yet. No. 3 Buck is practically anthracite screenings. We are trying that on 12 500 h.p. and 8 350 h.p. boilers exclusively, with what we believe to be very admirable results. We have also been using that in some Murphy stokers with forced draft, and got very good results, using 60 per cent. soft coal and 40 per cent. screenings.

MR. GEORGE A. STACY.* I should like to say that I have coal enough to last until next spring. Last winter we did have some rather poor coal. If it had been in the summer when we were building roads it would have been a question whether we would burn it or sell it to the stone crusher for road building. I think we would have got better results on the road. But it was black, and we had to put it through. So that we did the same as the rest. But the last coal we had is very good. It is not as good as we used to get, but I am satisfied that we are very much favored if all the coal that comes to New England is as good as that which is coming to us at this time. It is free-burning and we get very good results. I think that the Fuel Administration now in Massachusetts is doing, as far as I can observe, all that they possibly can. If the other manufacturers and pumping stations are supplied as well, — and I hope they will be, — I think New England is to be congratulated. There may be some spots where they are not so well supplied but it would be impossible to be perfect in the matter. But I think they have endeavored, as far as I can observe, to supply the essential — what we call the real essential — plants, and of course the water-works man thinks we are all there is to it when you come down to talk about his engines. They can go without beer, they can shut down the breweries; but they can't shut down the water plants. So that I think we are all pleased that we are supplied as well as we are, in our state, in regard to the quantity and quality of the coal, at the present time.

* Superintendent, Water Works, Marlboro, Mass.

MR. JOHN J. MOORE.* I noticed that Mr. Davis put anthracite screenings with soft coal, — 60 per cent. soft coal. Out in the section beyond, the water works are using 100 per cent. of the same stuff he is using 40 per cent. of in his pumping station. Also, a factory at Auburn, Pa., is using nothing but that anthracite coal. It is coal that can be bought at a very low figure, and does the work fully as well as soft coal on a forced draft. There is no soft coal mixed with it at all; the same kind of coal that you are burning at 40–60.

THE PRESIDENT. I do not think I made myself clear. We have 12 500 h.p. boilers and 8 350 h.p. boilers burning the anthracite No. 3 exclusively without any mixture. Then we have one other plant where we have 9 300 h.p. boilers with Murphy stokers, and in that one plant we are burning 40 per cent. screenings, because the stoker is not adapted to burn a complete anthracite mixture, though some Murphy stokers are burning that exclusively. But they have to have special grates to prevent the sifting of the fine material through. But with the Murphy stokers we have not been able to burn successfully over 40 per cent. But with the Cox stokers, of which we have 20, we are burning the No. 3 Buck alone without any mixing.

* Owner and Manager of Water Companies, Boston, Mass.

EXPEDIENCY OF RAISING WATER RATES TO OFFSET INCREASED COSTS.

BY JOHN J. MOORE.*

[*September 12, 1918.*]

Hon. Skelton Williams, Controller of the Currency, in his report to Congress for 1917, goes into detail about the decline in earning capacity of public utility corporations. He speaks of the danger as a national one, in the loss in efficiency of such utilities due to lack of funds to operate plants efficiently on account of the increased cost of material and wages. Mr. Williams urges upon public utility companies and on commissioners in the state the necessity of some action to lessen the danger to war work and industries, many of which are dependent in one way or another upon the service rendered by public utilities.

In a general way, the cost of materials used in operating water plants has, as most of you know, advanced all the way from 150 to 250 per cent. Fuel and wages have advanced 100 per cent. Figures which I quote are taken from the records of companies in which I am interested and in all of which we have either increased or asked for an increase in the water rates.

First, I would call your attention to an item which can hardly be considered under either materials or wages, and yet which has added greatly to the operating expense of many companies. I refer to taxes.

In one Massachusetts company eight or nine years ago we were paying to the town in taxes 50 per cent. less than what we were receiving from them in hydrant rental. Last year we paid them $1 300 more in taxes than we received from them in hydrant rental; that is, the amount paid to them was 30 per cent. more than the amount received from them.

In another Massachusetts company the taxes have advanced 43 per cent. in the last five years.

* Owner and Manager of Water Companies, Boston, Mass.

Operating costs in both of the above-mentioned companies have advanced during the last year in percentages varying from 50 to 80 per cent.

Where oil is used as fuel the increase is between 50 and 60 per cent. Where coal is used, the increase is about 80 per cent.

Wages of pumping stations have advanced from 30 to 45 per cent.

Wages of engineers have advanced 50 per cent. Day laborers have advanced 60 per cent. over 1917, which showed at least 30 or 40 per cent. advance over previous years.

Companies which two or three or even one year ago were earning an average of 8.8 per cent. on the capital stock are to-day earning 6.3 per cent. Companies which were earning, a year ago, an average of 4½ per cent. on the capital stock are to-day earning a little less than 2 per cent. on the capital stock.

Certain Maine water companies in which I am interested, and in which we have asked for an increase of rates, were built very shortly before the European war, and were unable to more than pay their operating costs. With the steadily mounting cost of labor and material, these companies are now unable to meet even the operating costs.

One of these Maine towns is a very good example of one of the reasons why a town or municipality should pay more for hydrant rental than has been customary in the past. The town is small and not compact, and many pipe lines are in streets where there are numbers of vacant lots. Now, these lots have increased in value since a water system was established in the town. The water company is obliged to pay for maintaining lines in the streets yet the company received not one cent of revenue from these lots.

This, in brief, is the problem many water companies are to-day facing. The question is, how to meet it. There seems to be only one way, and that is to raise the rates. Water companies are a necessity. The public must have water, and the companies cannot be expected to furnish it at a loss. Therefore there seems to be no question as to the necessity and wisdom of raising the rates to meet the increased cost. There is no other possible way to meet such cost unless it is to cut the dividends, and it is very rare to find a water company earning enough to pay any dividends

which could be cut and give any adequate return to stockholders. In such companies as are able to meet the increased costs and pay their dividends, there would of course be no excuse for increased rates. In towns where the system is a gravity one — or where the town is so compact as to have made the original cost of construction small, and where in past years the company has been able to create a surplus, it may be possible for them to meet increased costs and still pay a reasonable return on their investment during lean years.

Practically all water systems were built in good faith, and people who invested money to construct them felt that such investment was a conservative one, probably knowing that the return would never be large but would at least always be sure. We cannot therefore expect such investors to sit by and allow the old rates to stand in companies where doing so would mean under present increased costs that dividends on the invested capital could not be paid.

Probably the greatest question is how and where to get the increased rates. I have mentioned before that there is a question now as to what proportion of rates the towns should bear as compared to that paid by domestic users. The old idea was that the town should get all it possibly could for the lowest rental. In the West it has been held by public utility commission that the cost of building and maintaining a system of water works giving fire protection to a town or city is about $66\frac{2}{3}$ per cent. more than the cost of a system supplying water for domestic users only, and therefore the proportion of the burden of supporting a public utility in such a way as to render efficient service to the town or city should be greater for the town or city rather than for the domestic users.

In a recent decision given by the Maine Public Utility Commission it was stated that 25 per cent. of the total revenue necessary to operate a company and pay a fair return on the investment was not too large for the town to pay. (Guilford, Me.)

It is a much fairer adjustment of rates for towns and municipalities to bear the larger portion of the revenue required by water companies, but it becomes a matter of educating townspeople to this idea.

In a recent decision in Pennsylvania, the commission decided that a water company should be entitled to earn, in addition to the expense of operation and annual depreciation, a 7 per cent. return on the value of its plant. (York County Water Company.)

In another decision the same commission decided that a water company in a town where they ordered certain improvements should receive an 8 per cent. return on the valuation fixed by the commission. This valuation, by the way, was fixed by the commission as only fifteen thousand dollars less than the book value of the company. (Montrose, Pa.)

The California Commissioner also considers a net return of 8 per cent. on the valuation as a fair return. Taking an example a little nearer home, the Maine Utilities Commissioners have, in a decision rendered in 1917, stated that they consider 6 per cent. net income on the fair valuation of the properties of a water company a fair return on the investment. (Guilford.)

DISCUSSION.

[Remarks by Mr. Moore after finishing the reading of paper.]

MR. MOORE. I have had probably as much to do with these commissions as anybody that is here. I am interested in probably more water companies than any other one man. And I believe that instead of increasing the domestic rates to meet these increased expenses to which the companies have been put on account of the increased cost of fuel and labor, so as to pay the stockholders a fair return on their investment,— and water-company stock has been always considered all right, and held by estates and widows and orphans, — I believe that the towns and cities should pay a larger hydrant rental. In our state the towns pay a fair hydrant rental, but they get it all back in taxes, like the company that I referred to, which we are interested in. The company paid, last year, $1 300 more in taxes than they received for hydrant rental. Now, there is no question but what the company was the cause of a big growth in that town. When the company was installed, about seventeen years ago, the town had a valuation of about $3 000 000, while they now have a valuation of $12 000 000. At that time there were about 67 takers; now there are 1 200 to 1 400

water takers. The company asked the town to call a town meeting and increase the hydrant rental, which they refused to do, so the company has brought it before the commissioners to have them decide — which they have a right to do — whether the town shall pay a larger hydrant rental or the people shall pay a larger water rate.

In one of the towns in Maine where we had this same thing come up, we went to the town meeting and put it up to them in this same light, and they voted to increase the hydrant rental two hundred per cent. a year. I believe this is the fair way, because in all these towns there are miles of mains that are running by building lots that have more than doubled in value, and the owners are not paying anything at all for the use of the main. I believe that, by taxing those lots, and every other lot in the town in proportion, that is a fair way to get at the increased revenue that will have to be raised in order to give these water companies a fair return on their investments. I do not know of any of the water companies in this state (I am interested in three) that are earning more than a fair return on the amount of capital that is invested — none are earning over six per cent. — and I know of a number that are not paying any dividend at all, and never have earned money enough since they have been doing business to pay any. Since the increase in price of fuel and labor has occurred, on account of the war, some of the gentlemen who are interested in them tell me that they are not earning their operating expenses.

THE PRESIDENT. I should like to ask one question,— whether the hydrant rental in general is levied on each hydrant or whether there is any charge per mile of pipe or miles of mains that supply the hydrants.

MR. MOORE. It varies. Some communities pay so much a hydrant for each hydrant that is set, and some contracts with the towns say that a hydrant shall be set at intervals of 400, 500, or 600 ft. Some communities have made a contract for a certain sum for a certain number of hydrants, and all additional hydrants that are put in after that are free.

The company on which a hearing is to be held to-morrow made a contract originally with the town, back thirty-four or thirty-five years ago, that they should receive $1 200 a year for 30 hydrants,

and all additional hydrants should be set and owned by the town at the cost to the town for the hydrant setting, but no rental. The company had a ten-year contract which ran out twenty-odd years ago, but are still going under that same rating. The town, to-day, has 206 hydrants for $1 200 a year, where if this company had got what they ought to get for hydrant rental, for the number of hydrants they have set, they would not have to increase their rates. So that the town is getting its water too cheaply, and somebody has to pay money enough to the company to give a return to pay their dividends. For that reason the company have increased the domestic rates 22 per cent.

THE PRESIDENT. The reason I asked the question is that Mr. Moore mentioned the vacant lots, no property on them, no need of fire protection, but nevertheless of increased value, with an increased assessment and larger taxes because of the presence of water in the street. That situation seems to have been covered somewhat in rather a unique decision recently by the Pennsylvania Public Service Commission, which seemed to cover that very point when they made the charge to the town $7 a year, I think, on each hydrant, and $440 a year on each mile of pipe carrying a potential fire protection supply, which seemed to take care of the charges of the company in the area where there was a potential increase in the value of the property on account of the protection of the water.

MR. MOORE. There are some companies which on account of this war have had to increase their water supplies and spend a very large additional amount of money, to get water for the different factories that are working on war orders. I never believed in the sliding scale. I think the sliding scale is all right, but I think it slides the wrong way. I think a big user should pay more rather than less for his water. Instead of that, in most communities they start at a fixed rate. We will take, for instance, for a customer with a rate of 10 cents for the first 500 000 cu. ft., 8 cents for the next, and 7 cents for the next, and so on until the rate reaches 5 cents for all used in excess of a given amount. The extra cost of getting the water and laying large mains and putting in pumping stations and the extra amount of fuel is all caused by the big user of water, and the little fellow who has all the water

that he wants has to pay for the additional cost that is occasioned by the large user. I believe the big user should pay. I *do not* think there should be any downward sliding scale in meter rates. [*Applause.*]

I can give you a very good illustration, as I have a large experience in the different states. We are now providing an additional supply for the town of Walpole. There is one mill out there that uses more water than the pumping plant will pump. We built the system for them twenty-four years ago; Mr. Coffin, one of our late members, was the engineer at the time; and that plant is just as good to-day as the day it was built, pumps and everything else are doing the work. This is a little community, a town of about 2 000 or 2 200 taps, I think, and they have an elegant water supply from driven wells. The pump is of a million gallons capacity and they are running it up to 1 400 000, — just as much as they can make it do, night and day. I was there yesterday and their gage showed the water 40 ft. below the bottom of the standpipe. That is pretty nearly an every-day occurrence. I tried to get them, about five years ago, to enlarge the plant; but they didn't take action until this year. They are now spending $150 000 for what we could have put in two years ago for $50 000 or $60 000. That is all for one mill, the Lewis Mill, that is making war supplies. I asked the chairman of the commission what rate was being charged. He answered, " About seven cents." I said, " You are supplying them too cheaply; you ought to raise their rates." He did raise their rate to 12 cents and they made the greatest holler you ever heard, yet they are making barrels of money out of war supplies. They have a 4-in. supply pipe under 85-lb. pressure and you can imagine how much they will take, running wide open. It takes all the pump delivers, but they said, " Why not put this extra cost on to the private takers? Let them stand a part of the burden." Now, their plant was all right before the Lewis Mills were connected and took this water away from them. Why should the private takers pay any more? The large user is the one that these companies have had to spend the excessive amounts of money for and who makes it necessary to lay larger mains and put in more pumps. The extra cost comes on account of the excessive user of water,

and the large user is the one, in my estimation, who should pay, and the little fellow should not. I think the sliding scale is wrong there. It should be up instead of down.

In a recent hearing held before the Missouri Public Service Commission, the Commissioner held that in meter rates by water companies what is commonly called the " step rate " schedule is discriminatory. The statement of the commissioners " that the objectionable feature exists at the turning point where the consumer by increasing his consumption slightly is able to obtain a reduction in the total gross charge " is along the line I have just been speaking.

MR. FRANK L. FULLER.* I think Mr. Moore is about right on this question. Now, at Wellesley we have a good many greenhouses, and not so much lately but a few years ago they were very anxious to get a reduction in their rate. I always said, " Why should they pay less for their water than anybody else? There are plenty of poor people to whom the water rates are quite a hardship, who are getting no income from the water they are using, whereas the greenhouse men, to whom the water is a great necessity and from which they make a profit," — I don't know how good the greenhouse business is at the present time, — " why should they get their water at a less rate than anybody else, than the common person, the ordinary family? " We never made any change in their favor. I don't think we ought to. The people, as Mr. Moore has said, who are making money out of the use of the water certainly should not pay any less for it than those who use it as a necessity, in my opinion. And I think it is a point well taken.

Now, in regard to the price of water, I think some increase ordinarily ought to be made. I was talking, a few days ago, with a superintendent of water works, and he said, " A few years ago we dropped our rates so that they are very low, and we ought to increase them; but I suppose there would be a big kick if we did." But why should there? everything else is advancing. Now, at Wellesley we supply 16 000 gal. of water a year for $6. It is about the cheapest thing a man can buy. That is only 50 cents a month if he keeps within those limits. And what can he get for

* Civil Engineer, Boston, Mass.

50 cents a month that is equal to that? Of course we also have a low price on electric lights; but electric lights and water are two great necessities of housekeeping and living, and I don't think we ought to feel as though we couldn't bear a little increase in this matter.

MR. H. T. GIDLEY.* Is there any real reason why a manufacturer should pay less than the domestic consumer? It costs exactly as much to pump the water to him as it does to the small consumer. And in a good many cases the large consumers get their water for actually less than the cost of pumping, and the little fellow who pays the $10-a-year rate pays for the water the manufacturer uses. I can't see any justice in it at all. I think there should be a flat rate.

MR. MOORE. I agree to that. We sell the United States Government a lot of water in one of our plants, and they asked our superintendent for a low rate, — they wanted a sliding-scale rate. He brought it to me. I said, "We can do nothing except make the rate 35 cents for 750 gal., the same as to all other takers; we have to go out and spend a lot of money to see that they get this water; we were all right as we were; we have to spend a lot of money to give them the amount of water they want to use, and they must pay for it." I don't see why they should have water any cheaper than any of our individual users.

MR. GEORGE E. GORMLEY.† I fully agree with what Mr. Moore says about the rates. In our case we have one large manufacturing plant which uses about 6 million cubic feet in a year, and we are supplying them with water at just half the price that we charge the domestic consumer. But of course the small manufacturer is in between. Two or three years ago we had two mains running into that plant, — one 4-in. and one 6-in. The 4-in. was the factory supply and the 6-in. supplied the hydrant system. They took a feed-pipe that supplied the boiler house off the hydrant system, — a very poor plan. That was put in quite a number of years ago. We imagined that there was some water going into that plant that was not accounted for by the two meters in use. So I installed a 6-in. detector meter in the

* Superintendent, Fairhaven, Mass., Water Co.
† Water Commissioner, Abington, Mass.

street, that measured all the water that went into the plant, and the first month there was 4 500 cu. ft. that our meters had not accounted for. I do not know how long they had taken that quantity, but it made quite a difference.

MR. HUGH MCLEAN.* It gave me pleasure to hear the gentleman express himself in that way. Twelve or fourteen years ago, when we used to express our feelings about the rates, I contended that it was a burden supplying the larger customer. In my city of Holyoke we had three rates, — 15 cents, 10 cents, and 5 cents. We undertook to abolish the three rates and tried the experiment first of abolishing the 15-cent rate. We went along a year or so with the 5-cent and the 10-cent rates, and we met a lot of opposition from the owners of private water plants who claimed that it would be a loss to them, that their large consumers would withdraw from using their water and it would mean a benefit for the private concern. We eventually abolished all the rates in Holyoke, and we have one flat rate. Instead of having 5 cents, 10 cents, 15 cents, we raised the rate from 5 cents to $5\frac{2}{3}$, with a discount which makes 5.1. We have had no trouble since, and we get them just the same. If we have to raise the rates now I believe we should raise them to the large consumer and leave the rate of the small consumer as it is. I think the reason those rates were established on those bases some twenty-five or thirty years ago, when the works were built, was that the large mill owner of the town was one of the members of the water department and the rates were made in his interest. And it has continued to be so. But why should it be so? In dealing with the United States Government, if anybody wants to buy a million dollars' worth of postage stamps he has to pay for them at the same rate as the man who only buys one. Some years ago, when the trust problem confronted us, in the beginning of the trust era, we had a great many mills. Those mills had the three rates of 15, 10, and 5. But they combined, and then they said, "We will only pay one rate." And they obtained the lower rate and have held that, consequently resulting in a loss to us of about $3 000 a year water rates by their consolidation. We were able to meet them, on the other hand, by abolishing all these rates and making them pay the

*Water Commissioner, Holyoke, Mass.

flat rate. I have always contended that the large consumer was a burden to the water department rather than a benefit.

MR. CHARLES W. SHERMAN.* I do not want to take up the discussion of the sliding scale just now, but the point that Mr. McLean has just raised brings to my mind that Holyoke is the only place I have ever heard of where the water department of the municipality, or the water company, has admitted that the consolidation of companies ever made any less consumers. I think, so far as that particular thing is concerned, that they were rather "easy" in getting into that condition.

I was very much interested in Mr. Moore's data about the increase in taxes on water companies, and I hope before the paper is published he will be able to compile data from his several companies and give us something in figures as to the fluctuations and change in those rates. I have followed the figures of water companies that have come to my knowledge with a good deal of care for a number of years, and there is an unmistakable tendency for increased taxation of water companies. That may be equitable and right — I think in many cases it has been so, as in former years they were under-taxed. But I am sure that some are over-taxed at the present time. The range of taxes, as far as my observation goes, has been something between five and twenty-three per cent. of the gross revenue of the companies. If you take twenty-three per cent. of the gross revenue of the company for taxes it does not leave a great deal for depreciation and interest. And if that much is going to be taken in taxes, the company must be allowed to gain sufficiently in the rate to make it up. It can be assessed, I presume, to the extent of all the available revenue of the company. On the other hand, when you come to the five or six per cent. of the gross revenue, paid for taxes, which I think is the case in a few companies, it probably is less than a fair share of the taxable burden of the community.

The matter of hydrant rental for fire protection for municipalities is a most inequitable one in a very large number of cases. Of course it is known to all water-works men that a considerable portion of the cost of a water system is due to fire protection. In the very large cities it may be as low as 10 per cent.; and in the

*Civil Engineer, Boston Mass.; Water Commissioner, Belmont, Mass.

small ones, as much as 66 per cent. or more. The hydrant rates have usually been established without any reference to the actual cost, and in comparatively few cases has there been a systematic, scientific attempt to work out rates which are equitable and fair.

MR. J. M. DIVEN.* It is a little out of the line of discussion, but I should like to ask the gentleman from Holyoke if he dropped all his large consumers if he would not have to raise his rates to the small consumers.

MR. MCLEAN. No, we would not; because we have to provide a pumping station principally for them. They use so much of the water we have to build new reservoirs and larger mains to satisfy their large consumption. And they obtain a smaller rate, or less than what the rest of the consumers are paying. If they are only paying 5 cents and are using a million gallons a day, and the rest of the community is paying 15 cents and is using a half million a day, it would be a help to get rid of the large consumer. You would not have to supply the pumping station or reservoir.

MR. FULLER. We formerly, at Wellesley, supplied Wellesley College with water. They thought they could get it cheaper by putting in their own supply, which they did, and we were very glad they did it. I have never been able to find out just what it costs them now, but it seems to me it must be costing them as much as we were charging. But we knew we were supplying them at less than it really cost us to furnish the water, taking into account the cost of the works, depreciation, and so forth. Perhaps we ought not to have taken any depreciation into account, but I think, even without taking into account the matter of depreciation, that we were not getting for the water as much as it cost us, and we were very glad that they obtained their own supply. And I think that is the feeling, perhaps, of a good many water-works systems, — that these increases in the supply are not profitable. Some people think that when you once have a water-works plant established you should not, perhaps, charge anything for more water; that, while it takes a little more coal, it does not take any more engineering force, and all those things. But the

* Superintendent, Water Works, Troy, N. Y.

proper way to consider the matter is to divide the number of gallons that you supply by what it costs to supply that water, which I do not think is always taken into account.

MR. MCLEAN. Hydrants are quite often extended on land whose owner pays no water tax; hence, the water user should not be asked to pay more for his water on account of that situation. If it is extended a half mile or a mile, I think it is just to tax the owner of that land a dollar a foot for the extension, and tax the city for every hydrant that is put on the extension. We tax the city $8 per hydrant a year, and for every hydrant we put on an extension we tax the petitioners a dollar a foot, which I think is a just way. There is no reason why the extension of those hydrants ought to be added to the consumers' expenses for water.

MR. MOORE. That is true. You take a number of those lines where the works are owned in some places by the town and in other places by the company — and there are a great many miles of pipe that are laid and hydrants put on mains that are laid by tracts of vacant land. We have one case now where they have asked us to lay three miles of pipe to get to about a dozen houses. And in order to get us to lay that line, they agreed to take hydrants on the line, along a street where there is not a house within a mile, set them in every 500 ft. to put out any stone wall that might get afire, and pay $33.33 a hydrant, in order to get water up to those dozen houses. Of course we refused to go up there, because we couldn't get the money. But in that particular case they are proposing laying a number of miles by vacant land on both sides of the street that is going to be increased in value by the pipe line going by. When a pipe line runs by a house lot, that lot is worth more because they can get the water, and I believe that land should pay a higher tax. If that land is worth $500 an acre without the water, it should at least be doubled up and taxed for $1 000 an acre. But they do not do it in this particular case, but the rest of the community would have to bear the burden that the selectmen were going to put on them by running this pipe line up to take care of, I think, eight or ten houses at an expense of about $30 000.

MR. DIVEN. That is a speculation on the part of some land company.

MR. MOORE. That was a speculation on the part of the town. The company did not want to do it.

MR. DIVEN. But the owners of that land were the beneficiaries.

MR. MOORE. They would be the beneficiaries.

MR. DIVEN. My practice has been to let them pay for it, and then when they develop and there is business there to pay, take the line over and pay them for it. But until it does develop let them stand the entire cost. If the development does not amount to anything, they are out; the city is not. I do not see why the city should spend money to help along land speculation.

MR. MOORE. Well, that is true as far as the city is concerned, but in this particular case the city is not spending any large amount of money at any one time, but it is creating a tax on that city when they pay this hydrant rental, which they probably will never get any return on. We have all kinds of conditions in different communities; no two communities are alike.

MR. HENRY A. SYMONDS.* What is the attitude of the Public Utility Commissions and the general public towards meeting the question of increased rates?

MR. MOORE. That differs in different communities. As I said, in one town where we had to increase the rates I went there to a specially called town meeting and told my little story to them. I was asked by some of the leading men in the town what I thought was the proper and just way to get at it, and I told them that I thought — not because I was interested one way or the other — that the better way for them to do was to increase their hydrant rental and to put the whole burden on the town, and to leave their water rates as they were. The biggest taxpayer in that particular town was a big mill that paid better than half of the taxes paid in the town. They did not use any of the town water as they had their own water supply, but they had the benefit of this water system which was put in because it protected all of that property in the town; if the town was without a water works and it burned down, the mill would not have any homes for its help. They thought that was correct, and voted to increase the hydrant rental 200 per cent. That took care of that particular Maine town.

* Civil Engineer, Boston, Mass.

In a Massachusetts town we had a meeting called by the selectmen, and told them our story and the amount of money we would have to have in order to meet the extra expenses occasioned by the war, on account of our fuel, raising the help, and everything of that sort, and to continue paying the dividend of five per cent. We then asked them to appoint a committee, have them go to our office and take our books and go over them from the day the company was organized and see whether we were entitled to what we asked for, and if we were not we would throw up our hands, but if we were we wanted it. That committee was appointed by the chair, and went over the books in that particular town, taking about a month or six weeks in doing it, and when they got through I asked them how they came out. They said, "The only way we can figure it, you do not ask enough. [We asked a 33 per cent. raise.] We will leave the hydrant rental as it is, and let the consumers pay the difference"; which they did.

In another town I tried to do the same thing, and asked them to give us a hearing, but they would not do anything. They flew up in the air and said we were getting too much revenue anyway, and on account of my owning so many companies I had been paying myself a salary of $25 000 or $30 000 a year, and that was where all this money was going to. But, as it turns out, I am free to say that from all the companies I am president of or manage I do not receive one cent of salary. I do own a big block of the stock, and I get my dividends the same as in everything else, and I propose to charge rates enough to get it, too. But they would not give us a hearing, so that that is before the commission. It has not come up yet.

In another town I am interested in, we went to them and told them that we thought they ought to increase the hydrant rental to take care of a deficiency that we were going up against, and if we did not get additional revenue we would have to cut our dividend out altogether. They would not increase the hydrant rental, would not do anything with us, and we increased the rates 22 per cent. Then they employed what they figured to be the best talent in the state in the way of engineers and lawyers, and are coming before the commission to have the rates reduced,

and that hearing comes up to-morrow morning at ten o'clock. But I am free to say now that the rates will not be reduced. The tendency has been of the commissions, in all the different states that I am interested in — and I have been before the commissions in all of them on a number of different occasions — to give the company a fair return on the capital invested. Their idea of a fair return runs all the way from 6 to 8 per cent. In Massachusetts, the commissioners think that the companies should earn 8 per cent.; Maine says not less than 6; New Hampshire says 7 or 8. Those happen to be the three states that I have plants in at the present time, although we have a number in the West Indies. The attitude of the commissions seems to be to give the company a fair return on its investment. The Maine commission has gone so far as to say that officers of the companies — that is, the presidents and treasurers — should charge salaries. They never have, in any of the companies I am interested in. When we go there, we simply charge our expenses to and from the plant. And we have not any companies that pay over 8 per cent., but have some that are down as low as 4. We propose to make them all pay something, — pay their way and pay a dividend.

Mr. Samuel A. Agnew.* I find one of the greatest difficulties I have, in the town where I am, is to educate the people to the thought that the town does not own the water works. Now, it is a strange thing, but as a matter of fact the ordinary consumer knows absolutely nothing about what the works are or who the company consist of, except there is a faucet that they get water out of, and if it becomes yellow or dirty they kick.

Another great difficulty we have, even with the intelligent, is to show them the difference between a municipally owned works and a privately owned works. And they compare, for instance, our town, which is a small town, with Brookline or Belmont, or such places as that. They say, " We get our water for $8 a year, and have so many bathtubs or water-closets, and it costs me $6 or $8, while you people want to charge $40." They do not take into consideration the fact that they have a town to fall back on if the water department does not pay. We have no town to fall back on or to get an appropriation from to help us out. Now,

* Superintendent, Water Works, Scituate, Mass.

if there were a way to get at the people and educate them to the fact that we are simply a corporation or a concern that is out to do business and to sell our goods at a profit, we could help the matter a great deal; but that is a tremendously difficult thing to do. Now, this summer I have had a great deal to do, and I have hardly talked with an individual but that, after I got through with him, has seen the justice of our demand, of our asking the advanced rate. The difficulty is to get the town as a whole to see it. One or two men, or a dozen men, can't go around and act as missionaries for a water company and convince all the people of the town of the need of the advance. Now, if there was some way we could get at it and show them that here we are, an ordinary corporation, out to get a fair return on the investment, we could do a great deal better. Otherwise we are up against it and have to depend on the commissions to lay down the law and say that the people have to pay us so much money to keep the thing going.

MR. MOORE. I want to say another thing which you may know about. In the past year there have been a little above 500 applications from public utilities in New England, asking the Public Utility Commissioners to increase their rates — other companies as well as water companies; 487 out of 500 were granted.

THE PRESIDENT. At the rate asked for?

MR. MOORE. Either that or some rate; 487 out of the 500 got an increase. So that that shows how the public utility commissions look at this thing.

MR. FULLER. Those were private companies?

MR. MOORE. Yes. And we have had this same thing right out here, as you people know, in our street railroads. This is getting a little off from the subject, but in all of our communities we built street railways fifteen, twenty, or twenty-five years ago, and when they were first built they were all paying a fair return on the investment to the stockholders. Most every one of them paid a little dividend to start with. Then the price of labor and materials went up; but the fare was still 5 cents. That did not go up. Everything else doubled; until finally they couldn't even buy their rails and ties, or keep their cars or power houses in repair, and some of them did not even get money enough to buy their fuel.

Now, if our public utility commissions had had backbone enough at that time, had not been playing politics too much, and had allowed these roads to increase their fares to 6, 7, 8, or 10 cents, which is little enough to ride on any of those lines, we would have had a different proposition on our street railways to-day than we have. Here is our Boston Elevated, which you all know. The state would not let them increase their rates. They appointed trustees who increased the fare to 7 cents. Now the trustees propose a second increase to 9 cents. They ought not to stop at 9 cents; they ought to make it 10 cents, and then they should give them zones to ride in for 10 cents and not let them ride all over and around Robin Hood's barn. I can get on a car at Arlington, connect with the Elevated, go to Forest Hills, then take a surface car at Forest Hills and go clear to the Boston line, pretty nearly to Dedham, for 7 cents. That is not right. It is just the same with the water company. Everything with them has increased in the last eight or ten years, particularly in the last three years since the war has been going on. One street railway in particular I put $28 000 into when built, — of good, clean, hard cash, — because I thought we ought to have a road in the community. It paid me a dividend for five or six years; but that stock to-day is not worth the paper it is written on. Is there any reason why it should not be worth as much now as it was twenty-five years ago? Not a reason in the world. The community is getting the benefit of my money, and it should pay rates enough to give a return on my investment. It is just the same with the water companies.

Mr. Frederic I. Winslow.* The argument presented by Mr. Moore that the large consumer should pay more rather than less than the smaller consumer per gallon for water appears to have stirred a responsive chord in the minds of the members present, and all the remarks seemed to agree with his point of view. In presenting the opposite side of the case, the writer does not do so from a conviction of its soundness so much as from a feeling that the question may have two sides.

The chief argument has hitherto been the wholesale *versus* retail argument; that is, that in all lines of trade the large order

* Consulting Engineer, Boston, Mass.

receives the benefit of a lower price, and that in the sale of water this rule should be observed. In very few cases, however, is this rule observed in water-works practice where the wholesale consumer has his buildings widely scattered, but only where the water is all taken from one large tap.

The extra amount pumped in such cases can hardly cost any less per gallon for the large amount than for the smaller. Where the supply is wholly gravity, the cost would not vary at all. As the mains have to be somewhat larger, on the whole, to accommodate the large consumer, there would, it seems, appear to be some argument for charging him more.

The only reason for charging him less equitably would be in the case — and this case occurs very frequently in large communities — where a large consumer is between or near smaller ones or in any location where it requires very little main pipe to surround his property or to pipe it for his necessities. In this case it is frequently the case that a few hundred feet of pipe are laid for a heavy consumer while at the same time the municipality will lay a much greater length for a very much smaller revenue. It is probably for this reason, coupled with the general wholesale price principle, which has brought about the discrimination in rates.

REPORT OF THE COMMITTEE TO INVESTIGATE CONDITIONS IN WATER-DISTRIBUTION SYSTEMS ARISING FROM THE SEVERE COLD OF WINTER OF 1917–18.

[*September 11, 1918.*]

MEMBERS OF THE
NEW ENGLAND WATER WORKS ASSOCIATION:

Gentlemen, — The Committee to Investigate Conditions in Water-Distribution Systems Arising from the Severe Cold of Winter of 1917–18 respectfully submits the following report.

Two hundred and thirteen questionnaires, similar to the form appended, were sent out, and ninety-five replies were received.

The results of our investigations and answers to questionnaire have been summarized in detail in the appended table.

Very few of the active superintendents and managers of to-day have ever experienced such a condition as prevailed from about the middle of November, 1917, until the middle of March, 1918, nor are there many of the New England superintendents who could reply to the questionnaire as did one man in Maine. He reported no services frozen, no main pipes frozen, and to the questions on temperature and frost penetration could give no answer, as he had been in Florida all winter.

Some of us wished we were in Florida, but thought we were in a place reported to be even warmer. Sherman's well-known definition of war had nothing on what the life of a water-works superintendent was last winter.

Unusually long stretches of extremely cold weather and an absence of snow made ideal conditions for the penetration of frost.

The following data, compiled from the records of the United States Weather Bureau in Boston, Mass., clearly show the unusual character of the weather the past winter.

	Degree.
The average mean temperature for last December, January and February was	24.
The average normal temperature for the same months for the past 48 years was	28.9

The six coldest years, considering the months of December, January, and February only, and excluding 1917–18, for the past forty-eight years, were as follows:

		Degree.
1874–75	Average mean temperature for Dec., Jan., and Feb.....	24.3
1872–73	Average mean temperature for Dec., Jan., and Feb.....	24.7
1903–04	Average mean temperature for Dec., Jan., and Feb.....	24.7
1904–05	Average mean temperature for Dec., Jan., and Feb.....	24.7
1880–81	Average mean temperature for Dec., Jan., and Feb.....	25.4
1892–93	Average mean temperature for Dec., Jan., and Feb.....	26.

The following further temperature data, compiled from the records of the United States Weather Bureau at Post Office Building, Boston, Mass., is presented:

	Nov.	Dec.	Jan.	Feb.	Mar.
Highest for month, 1917–18.....	65	48	54	57	69
Lowest for month, 1917–18.....	13	−14	−3	−10	11
Mean for month, 1917–18.....	39	23.7	21	27	37
Highest in 48 years.....	76	69	70	64	78
Lowest in 48 years.....	−2*	−14	−13†	−11‡	−8§
Average daily excess or deficiency, 1917–18, compared with normal for 48 years.....	−1.8	−7.9	−6	−1.1	+1.7
Accumulated monthly excess or deficiency, 1917–18, compared with normal for 48 years.....	−54	−245	−184	−27	+54

	1917.			1918.	
	Nov.	Dec.	Jan.	Feb.	Mar.
Snowfall in inches, 1917–18.....	2.2	7.	13.8	5.7	12.8
Snow on ground end of month, '17–'18,	Trace	.3	4.6	Trace	None

The snowfall was light. In November it was negligible; in December there were eight snowfalls of less than 0.9 inches and one of 3.7 inches, immediately followed by rain; in January there were six snowfalls of less than 0.8 inches, one of 3.2 inches, immediately followed by rain, one of 3.0 inches, two of 2.0 inches, and one of 1.1 inches; in February there were four snowfalls of less than 0.8 inches, one of 1.8 inches, one of 1.2 inches, and one of 1.0 inch.

Depths to which main pipes and services were laid seemed to make little difference, for in the localities where pipes were laid according to the average frost penetration of previous years, the

* 1875. † 1882. ‡ 1896–1914. § 1872.

frost went just a little deeper this year. In fact, the frost was no respecter of places or persons, as a questionnaire missent to Canton, Miss., came back with the information that the minimum temperature was 10 degrees above zero, and that there was one inch of snow upon the ground. Our good friend John H. Walsh, of East Hartford, Conn., reported that he had 625 frozen services, affecting 785 families, rich and poor alike.

Aside from the inconvenience and danger of sickness through lack of sanitary arrangements caused by frozen services, frozen hydrants were the cause of much worry and a great amount of labor to the man in charge, and of danger to the community. Not only did they freeze, due to slight leaks on the valves and the entrance of ground water through the drips, but in some soils they were raised by the action of the frost on the ground so that they were severed from the lateral. Many more cases have been reported of hydrants broken off above the valve, the break not being discovered until the hydrant was used, or upon inspection during the spring and summer. It is probable that much more hydrant trouble has occurred than has been reported, owing to the lack of regular inspection of hydrants by the smaller towns.

The meter companies ought to be able to declare extra dividends this year, for everybody seems to have been hard hit by frozen meters. From a study of the summary it would seem that it made no difference whether a meter was set in the cellar or in a box outside, although, if an explanation from places showing a small percentage of outside meters frozen could be had, it might appear that those meters which were set at the depth of the service in a well-constructed vault were the ones to escape injury.

The methods used to thaw mains and services were many and varied, from the pick, shovel, and teakettle, as illustrated by a member from one of our Massachusetts islands, to the "natural" method used by a neighbor on an adjacent island. We are of the opinion, after scanning the bills for thawing, that this latter method is by far the simplest and most economical, provided you can get your consumer to agree to wait for these natural results.

Hot water and steam were used in many cases, but they are manifestly not best suited for conditions which prevailed during the past winter.

The calls for help that went out from the water-works fraternity to their brethren of the electrical fraternity resulted in the development of many types of electrical thawing apparatus.

The one best known and most generally used was through the overhead wires of the lighting companies. In this type the high-tension primary wires, carrying 2 200 to 2 400 volts, were tapped and the current carried to cut-out boxes with suitable fuse wires. From the fuse boxes the wire ran to one or more transformers whose capacities ranged from 15 kw. to 75 kw.

In the large majority of cases the voltage was reduced by the transformers to 110, and the amount of current delivered upon the pipe was further controlled by the use of a water rheostat.

The motor-generator set was used to a considerable extent.

One outfit consisted of a 25-volt, 250-ampere, direct-current generator, equipped with a volt-meter, an ammeter and an automatic circuit breaker, mounted on a Ford truck. On the truck was also mounted a countershaft carrying a sprocket wheel at each end, and a driving pulley which was connected to the generator by means of a leather belt. On each side of the jackshaft of the truck was attached a new sprocket wheel just outside of the existing driving sprockets. Upon arrival at the point where the work was to be done, the chains were taken off the driving sprockets and attached to the new sprockets at the jackshaft and to those on the countershaft mounted on the truck. The Ford engine was thus utilized to generate the required current.

The storage battery was used to a limited extent.

One outfit consisted of three trays, each containing eight 2-volt cells, so connected up that a voltage of 16, 32, or 48 could be obtained. Another of six trays of four 2-volt cells each was still more flexible, as voltages of 8, 16, 24, 30, 36, and 42 were possible.

Another of six trays of three 2-volt cells was connected in multiple series, giving a voltage of 35. This outfit proved unsatisfactory, as serious damage was done to the pipes in a number of cases.

The properly connected storage battery has proved very efficient. Like the motor-generator set, it is flexible and portable, and, when operated by an experienced man, it is a safe method. If improperly used, damage to the pipes and to the battery itself can easily result.

The batteries must be recharged after a continuous day's use, the operation taking eight hours' time.

The storage battery is delicately constructed, and can be easily damaged, both in discharging and in recharging. It deteriorates when not in use, especially during the long period of the year when it is not needed.

To reduce the probability of damage to a minimum, an experienced man should be in charge of the work, instruments to determine both voltage and amperage should be used, reasonable time should be taken for the actual work of thawing, and under no conditions should a larger current be used than experience has shown to be reasonable under similar conditions.

While available data are to some extent conflicting, and more exact information is desirable, yet general experience shows that, for the work of thawing $\frac{5}{8}$-in. lead or $\frac{3}{4}$-in. iron service pipes of average length, using 4/0 wire for leads, and with good connections, the following data may be considered as approximately normal:

Drop in pipe	14 to 18 volts.
Total voltage required	20 to 30 volts.
Amperes required	175 to 225 volts.
Time required to thaw	6 minutes, plus or minus.

With larger pipes, or with pipes longer than the average, of course more electrical energy and time is required.

For all-round, efficient, economical work, your committee looks most favorably upon the motor-generator set. It is flexible, can go where the work is to be done, can work continuously, does not deteriorate when not in use, can be made almost fool-proof, and, if properly designed, is the safest type of apparatus from the point of view of danger to the water pipes.

FRANK J. GIFFORD,
THOMAS E. LALLY,
DAVID A. HEFFERNAN,
F. A. MCINNES,
Committee.

NEW ENGLAND WATER WORKS ASSOCIATION.

COMMITTEE TO INVESTIGATE CONDITIONS IN WATER-DISTRIBUTION SYSTEMS ARISING FROM SEVERE COLD OF WINTER OF 1917–18.

FRANK J. GIFFORD, Supt. Water Company, Dedham, Mass.
THOMAS E. LALLY, Assistant Engineer, Water Service, Boston, Mass.
FRANK A. McINNES, Division Engineer, Sewer and Water Service, Boston, Mass.
DAVID A. HEFFERNAN, Supt. Water Works, Milton, Mass.

The Committee is called upon to make its report at the September meeting of the Association and *it is essential that return be made before June 1, next. Please fill out this blank and return it to Frank J. Gifford, Superintendent Water Company, Dedham, Mass.*

Name of city or town. *Date*

Municipally or privately owned.

Number of services in use.

Number of services frozen.

Depths to which services are laid.

Material used for services.

Miles of main pipe in use.

Lengths and sizes of main pipe frozen.

How many of frozen mains were dead ends?

Depths to which mains are laid.

Material used for mains.

Number of hydrants in use.

Number of hydrants frozen.

Number of hydrant connections frozen where main was not frozen.

Number of inside meters in use.

Number of inside meters frozen.

Number of outside meters in use.

Number of outside meters frozen.

Is the supply from springs, wells, or from surface sources?

What was the average temperature of the water at source of supply?

What was the minimum temperature of the water at source of supply?

What was the minimum temperature of water in the distribution system?

Give, if possible, maximum, minimum and average temperature of air monthly from November 1, 1917, to April 1, 1918.

Character of soil where frost penetration was greatest.

Greatest depth to which frost penetrated.

Average depth to which frost penetrated.

Average depth of snow on ground.

What methods were employed in thawing services?

What methods were employed in thawing mains?

Average cost per service of thawing by different methods employed.

Will owner, occupant or municipality pay cost of thawing services?

Will owner, occupant or municipality pay cost of meter repairs?

Does consumer or municipality own meter?

What allowance was made to consumer for water wasted through meter to prevent freezing?

If meter was out for any considerable time will any charge be made for water during this period?

State on what basis estimate will be made.

Please furnish detailed description, sketch, and photo, if available, of thawing apparatus used, however simple it may have been.

Your committee is ambitious to make this report as helpful as possible to the other fellow.

Name of person furnishing information.

Official position.

Address.

Discussion.

Mr. F. A. McInnes.* As one member of the committee, I should like to say that what most impressed me was the necessity of getting all the knowledge which was available, all the knowledge we could get, as to how we could thaw without doing damage, for it seemed to me that more damage has been done in the past than we fully realize. Along that particular line I should like to hear a lot of discussion.

We made a very successful use of the storage battery last winter after we had discovered that it was a dangerous tool to work with unless it was intelligently operated. By dividing our battery — we had 24 cells — into three trays of 8 cells each, with the multiple of a possible voltage of 16 cells in each unit, we were very successful. But our first attempts, when some of our men, without stopping to think what the result would be, went ahead with the full 24 cells in series, were disastrous. Our work was arranged so that we carried it on twenty-four hours a day, as nearly as we could, taking eight hours out of each twenty-four for recharging a battery. As far as I have been able to determine the deprecia-

* Division Engineer, Sewer and Water Service, Boston, Mass.

tion of a battery during the winter's service, it was about one-third, that is, about 30 per cent., which is not serious. What will happen after it lies idle all summer and then has again to be put in condition is another matter. But the actual operation of the storage battery properly regulated was entirely satisfactory, although personally I am not convinced that it is not too complicated a piece of machinery for general purposes.

MR. J. M. DIVEN.* How did the cost compare with other methods?

MR. MCINNES. It was cheaper than the others. Buying the storage battery outright and doing the work with our own men, it was very cheap.

MR. DIVEN. Does that include the depreciation?

MR. MCINNES. Yes. It was the cheapest method we used. We didn't use a generator set.

MR. CALEB M. SAVILLE.† We had between six and seven hundred services frozen at Hartford, and about half of them we thawed by electricity, using a storage battery, and about half of them by the steam method. So far as the cost was concerned there seemed to be little difference. One of the objections Mr. McInnes has spoken of, that is, the deterioration of the batteries during the summer, we overcome in a way, because the street-cleaning department in Hartford uses storage batteries, and the street-sweeping machines, of course, are not used during the winter time. We were very fortunate in being able to take the batteries from the machines — there happened to be five of them — and put them on our own platform trucks and take them around where we wanted to. So in our case it was quite an economical way of doing.

MR. FRANK L. FULLER.‡ I should like to ask Mr. McInnes how long it takes to charge these batteries after they have been used, and whether he didn't have to have several of them in order to provide for that.

MR. MCINNES. The time of charging was eight hours. There again intelligence is needed, for the charging must be properly

* Superintendent Water Works, Troy, N. Y.
† Superintendent Water Works, Hartford, Conn.
‡ Civil Engineer, Boston, Mass.

done. The batteries can be destroyed by improper charging as well as by improper discharging.

MR. GEORGE F. MERRILL.* The conditions vary considerably throughout New England. In Greenfield we have from four to six feet of snow when in other places they have very little snow. Our trouble with frozen pipes is confined very largely to the services; we have very few leaks that occur in the streets. I hardly agree with the committee's decision on the electrical apparatus for thawing. I believe the light, portable thawing machine that uses hot water, where you only have to thaw a service a short distance, is much more economical and quicker than the electrical. Of course if you have a long distance to thaw and there are a great many of your services frozen in a certain locality, you can make electrical connections quicker and can save time; but if they are isolated services, perhaps a half mile apart, the small, portable machine will give you much quicker results and will be more economical.

MR. DIVEN. Mr. Davis thinks all trouble centers in Troy; I think so myself sometimes. The cold weather performed another service for us there and gave a very good argument against laying laterals to the curb when the streets were to be paved. Thousands of them froze. The frost penetrated to an average depth of about $5\frac{1}{2}$ ft. The number that froze was innumerable, — from 50 to 100. Everywhere those sub-laterals froze and burst. Their utility is perhaps rather doubtful. Usually when the house is built the lateral is not in the right place and another service is required. Of course the object is to save tearing up the pavement, but it doesn't save it in this case.

MR. GIFFORD. I want to say to Mr. Merrill that the committee did not take any one locality into consideration in recommending electricity over hot water. But for the conditions that prevailed last winter in general throughout New England the electrical power was considered best.

MR. THOMAS E. LALLY.† I should like to say a few words about thawing by electricity. I was detailed last winter by Mr. McInnes to follow the electric machines, and we have had four or five

* Superintendent Water Works, Greenfield, Mass.
† Assistant Engineer, Boston Water Department.

batteries, and I think,at one time, seven overhead feed machines out. I did not follow each one every day, but I went around from one to another. And I remember going one day to Fulton Street and picking up a machine that was thawing by direct current through the mains in the city proper. It was raining very hard and the man in the manhole was kicking because of the short circuits that he got off the cable. It brought up the discussion whether we would stop or not. I told him I thought if he used due care he could get along. " Well," he said, " we had some trouble last night down on Cambridge Street. About eight o'clock we had a frozen service at a barber shop, and we hooked up to the manhole and the pipe inside. There was a fellow in the chair getting a shave, and the first thing we knew we had a lot of fireworks in the hand bowl where they give the shampoos, and the barber jumped and cut the fellow's face, and the fellow jumped up and ran out of the shop! " I have followed this thawing gang since 1912, so I took everything they told me with a grain of salt. I have a conversational knowledge of electricity, and I thought, — " How the deuce did this happen?" So I looked at his method of thawing and began to think about it. I reported to Mr. McInnes that they had had a little trouble, and that was the end of it for a couple of days. Then we got a claim from the agent of the building saying that the shop had been destroyed by the electric current used to thaw, and the claim was turned over to me to investigate. It was the ordinary front-store barber shop, on the ground floor, and directly back from the door was the hand bowl with the combination faucet, where the cold and hot water mix, and a little rubber hose on it. I found that the check-nuts holding the cocks into the bowl, which was porcelain-lined, were burned off, fused, and also the brass nut that was over it. They said they had got a plumber and had already connected up the cold water again, but the plumber had the piece of pipe. It happened the plumbing shop was overhead. So they showed me the pipe, and there were several places on it where the current had passed either from or to the pipe and had melted it out. The faucets were also fused. I talked with the barber, who was an Italian. He said, " Fine, fine; just the same as a small boy's fireworks, — up in the air! The fellow ran out

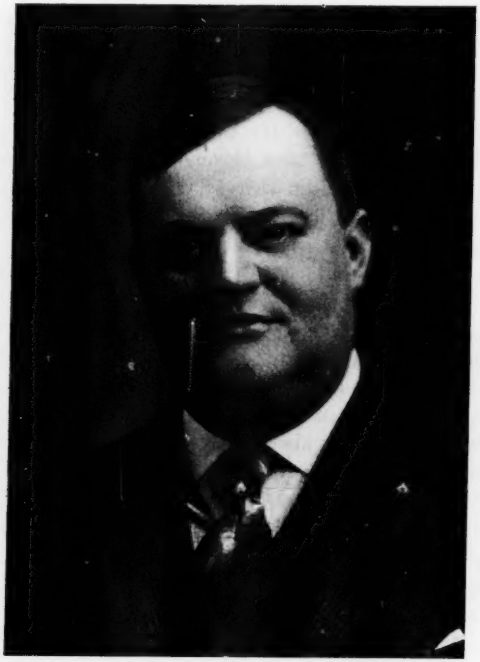
and I couldn't get him back." The whole story was just this: The thawing men had just wires and the old salt barrel. They had grounded the cable in the manhole, and ran their sub or lead from the wire which they cut into the cable to get through the water rheostat and get to the pipe just inside the cellar wall. Now, there was only one possible way that that current could get up to where the damage was done, and that was the fact that the pipe in the building was not disconnected from the house service. In other words, they simply hooked on to it without disconnecting anything. The result was that one end of the line being grounded, the current passed up through the house, and where the water-supply main ran up alongside a drain pipe there was a jam. There was also a jam where the porcelain around the bowl had been broken off putting in the connection — of course the porcelain lining around those bowls is never perfect at the holes — and the current simply jumped from the water pipe to the soil pipe and followed the iron soil pipe back through the ground to make the ground return to the Edison current. This only illustrates that if you are going to use electric thawing you ought to disconnect the house end from the street end in order to prevent any current from coming back in that way if there is a current. I find that most of the men doing thawing down town in the city proper — that is, north of Northampton Street — where direct current is the only service available, simply ground in the manhole and run their power from the manhole through whatever rheostat they are using, — a barrel is about all they use around here. But if they do not disconnect there is always the danger, no matter how little current they use, that there may be a short circuit somewhere in the house to the drain pipe.

THE PRESIDENT. I am assuming that the larger part of this discussion will come after the paper has been printed, with all the statistics. It is altogether too valuable a paper and contains too much useful information to be passed over lightly.

WILLIAM F. WOODBURN.

An Appreciation.

In the sudden death of William F. Woodburn, the New England Water Works Association has suffered a real loss. Though



not eligible, as a manufacturer's agent, for personal membership, no active member has been more keenly interested in the progress of the Association, or more jealous of its good name.

His work as chairman of the Committee in Charge of Exhibits for several years is well known, and the announcement that "Billy Woodburn will have charge of the exhibits" was always an assurance of success in this feature of the annual conventions.

A clean, capable salesman, his life illustrates in rare degree the influence of a winsome and unselfish personality, and to many engineers and superintendents the thought that no more will he break the routine of their days by his wholesome, honest, good cheer will be a very personal sorrow.

The undersigned take this opportunity to record their sense of personal loss and of loss to the Association, in the death of Mr. Woodburn, believing that it will find echo in the hearts of many other members.

LEONARD METCALF.
FRANK A. BARBOUR.
CHARLES W. SHERMAN.

PROCEEDINGS.

Meeting of June 19, 1918.

The June meeting of the Association included a Field Day and Excursion in conjunction with the Boston Society of Civil Engineers, members meeting at Rowe's Wharf, Boston, at 10.15 A.M., and proceeding by boat of the Nantasket Beach Steamboat Company to Pemberton, where an enjoyable day was spent.

A ball game was held in the morning between teams representing the two organizations, resulting in a victory for the New England Water Works Association.

Dinner was had at the Pemberton Inn at 1.30, followed by a very interesting address on War Conditions, by Maj. Kenneth D. Marlatt, of the Fourth Canadian Mounted Rifles, who was introduced by President Spofford, of the Boston Society of Civil Engineers.

A business meeting of the Association was held later, followed by a boat trip to Nantasket, after which members returned by boat to Boston.

At the business meeting Vice-President Killam presided. Three applications for membership were received, properly endorsed, and recommended by the Executive Committee, and the applicants, viz., H. J. Carroll, Rumford, Me.; LeRoy M. Peterson, superintendent Duxbury Fire and Water District, Millbrook, Mass., and James W. Routh, chief engineer Rochester Bureau of Municipal Research, Rochester, N. Y., were by unanimous vote made members of the Association.

Following discussion on the subject of Priorities, it was voted: That a committee of three be appointed to voice the protest of the New England Water Works Association to the proper authorities against the inclusion of the manufacture of meters, or other water-works supplies, in the class of non-essential industries. Vice-President Killam later appointed, as a Committee on Priorities, Willard Kent, A. E. Martin, and Hiram Allen Miller.

Adjourned.

Attest, WILLARD KENT, *Secretary.*

"WIN-THE-WAR-MEETING."

CHIPMAN HALL, TREMONT BUILDING,
BOSTON, MASS., September 11, 1918.

Carleton E. Davis, President, presiding.
The following members and guests were present:

HONORARY MEMBERS.

E. C. Brooks.
F. E. Hall.
W. T. Sedgwick.
G. A. Stacy.
F. P. Stearns.
R. J. Thomas. — 6.

MEMBERS.

S. A. Agnew.
T. C. Atwood.
M. N. Baker.
L. M. Bancroft.
G. W. Batchelder.
C. S. Beaudry.
C. A. Bingham.
A. E. Blackmer.
J. W. Blackmer.
Bertram Brewer.
A. N. Burnie.
E. D. Chadbourne.
R. L. Cochran.
F. L. Cole.
J. E. Conley.
H. R. Cooper.
H. C. Crowell.
John Cullen.
F. L. Cushing.
F. A. Darling.
C. E. Davis.
J. H. Dillon.
J. M. Diven.
A. O. Doane.
H. F. Dunham.
E. D. Eldredge.
Frank Emerson.
B. R. Felton.
F. L. Fuller.
Patrick Gear.
H. T. Gidley.
F. J. Gifford.
H. J. Goodale.
W. M. Gooding.
X. H. Goodnough.
E. A. W. Hammatt.
H. A. Hanscom.
A. R. Hathaway.
D. A. Heffernan.
C. R. Hildred.
J. L. Howard.
A. C. Howes.
J. A. Hoy.
W. F. Hunt.
J. W. Kay.
R. F. Kay.
Willard Kent.
J. A. Kienle.
J. W. Killam.
S. E. Killam.
G. A. King.
T. E. Lally.
P. J. Lucey.
F. A. McInnes.
Thomas McKenzie.
Hugh McLean.
H. V. Macksey.
A. E. Martin.
W .P. Mason.
F. E. Merrill.
G. F. Merrill.
M. L. Miller.
J. J. Moore.
P. T. Mullin.
William Naylor.
Henry Newhall.
R. J. Newsom.
F. L. Northrop.
H. E. Perry.
E. W. Quinn.
G. A. Sampson.
C. M. Saville.
A. L. Sawyer.
W. P. Schwabe.
G. G. Shedd.
C. W. Sherman.
G. H. Snell.
W. F. Sullivan.
H. A. Symonds.
R. L. Tarr.
L. D. Thorpe.
J. L. Tighe.
S. E. Tinkham.
E. J. Titcomb.
E. M. Tolman.
J. H. Walsh.
R. M. Whittet.
H. F. P. Wilkins.
F. I. Winslow.
I. S. Wood.
M. B. Wright. — 91.

ASSOCIATES.

American City, The, by J. H. Van Buren.
Bond, H. L., Co., by F. M. Bates and J. W. Gleeson.
Central Brass Mfg. Co., The, by M. J. Hirschfield.
Chapman Valve Mfg. Co., by J. T. Mulgrew.
Edson Mfg. Co., by H. L. B. Watson.
Engineering News-Record, by I. S. Holbrook.
Fire and Water Engineering, by Louis Ernst.
Hayes Pump Machinery Co., by F. H. Hayes and J. Howard Hayes.
Hersey Mfg. Co., by J. Herman Smith.
Leadite Company, The, by George McKay, Jr.
Lead Lined Iron Pump Co., by T. E. Dwyer.
Ludlow Valve Mfg. Co., by A. R. Taylor.
Mueller, H., Mfg. Co., by C. J. G. Haas.
National Meter Co., by J. G. Lufkin and H. L. Weston.
National Tube Co., by H. T. Miller.
National Water Main Cleaning Co., by B. B. Hodgman.
Neptune Meter Co., by H. H. Kinsey.
Pitometer Company, The, by E. D. Case.
Pittsburgh Meter Co., by J. W. Turner and V. E. Arnold.
Rensselaer Valve Co., by J. S. Warde, Jr., and C. L. Brown.
Thomson Meter Co., by E. M. Shedd.
Union Water Meter Co., by D. K. Otis and H. W. Jacobs.
United States Brass Co., by G. A. Caldwell.
Warren Foundry & Machine Co., by W. F. Woodburn.
Water Works Equipment Co., by W. H. Van Winkle.
Worthington Pump and Machinery Corp., by Samuel Harrison and E. P. Howard. — 33.

GUESTS.

MAINE. *Augusta*, Roy F. Searle.

MASSACHUSETTS.

Belmont, Prof. Arthur E. Norton.
Boston, James P. Bacon, Mrs. S. E. Killam, Raymond M. Kinsman, N. C. Sipprelle, L. Lee Street.
Cambridge, Thomas M. Mullins.
Danvers, Roger W. Esty and J. Ellison Morse.
Greenfield, Mrs. George F. Merrill and Winthrop T. Noyes.
Marblehead, Henry M. Wilkins.
Peabody, Archie Emerson.
Worcester, Prof. Ira N. Hollis and Hon. John G. Holmes.

RHODE ISLAND. *Bristol*, J. M. Jones.

NEW YORK.

Glens Falls, Ernest L. H. Meyer.
New York City, R. E. Brown.

NEW JERSEY. *East Orange*, Roswell M. Roper.

PENNSYLVANIA.

Philadelphia, E. M. Nichols.
Pittsburgh, George F. Maglott. — 22.

THE PRESIDENT. You notice that the first number on the program is "President's Address," but as this is war time, and we are requested by the authorities in Washington to dispense with all luxuries, the President's address on this occasion will be omitted and we will come directly down to business.

There was considerable discussion as to what we should have in the way of an annual meeting this year; that is, whether we should have the ordinary convention with the usual convention features of excursions and entertainments and so forth; and it was finally decided, and I believe we are all agreed that it was decided properly, that we should cut out this year practically all those features. I think the committee which has planned our program deserves a great deal of credit. The program they have outlined I believe will prove to be a very interesting and useful one, and the reports we have heard lead us to think that there will be a very large attendance this afternoon and to-morrow, considering all the circumstances. Of course the train service is irregular, and even our Secretary has not been able to get here this morning because of train delays. Mr. Sherman is to act as Secretary *pro tem.*, and he will now present the report of the Executive Committee.

MR. C. W. SHERMAN. The applications for membership, properly endorsed and approved by the Executive Committee, are as follows:

Henry F. Beal, superintendent Waltham Water Department, Waltham, Mass.; Isaac S. Walker, Philadelphia, Pa., water supply (general manager New Chester Water Company), sewage disposal; Frank A. Mazzur, Waban, Mass., installation of power and water-works pumping plants.

On motion of Mr. Bancroft, the Secretary *pro tem.* was directed to cast the ballot of the Association for the applicants whose names had been read, and he having done so, they were declared duly elected members of the Association.

MR. SHERMAN. The only other item of business in the Secretary's office here is a letter from our friend Walter H. Richards, of New London, Conn., which I will read.

NEW LONDON, CONN., September 3, 1918.

MR. WILLARD KENT,
Secretary of the N. E. W. W. Association,
715 TREMONT TEMPLE, BOSTON, MASS.

Dear Sir, — As I shall be unable to attend the meeting of September, 1918, I would suggest that if the meeting is, as it should be, an entirely patriotic one, I would like to reiterate my remarks of last September when I urged that all municipal expenditures be reduced to those "necessary for the preservation of life and health." I would suggest also that a copy of the Resolution adopted at that time be sent to the mayor or executive officer of each city in New England represented in the Society.

Furthermore, the circular calling attention to the saving of coal by saving water does not apply to the many cities supplied by gravity which are on the verge of a shortage, particularly should the season be dry, and to such a rigid inspection supplemented by the use of meters might postpone a large expenditure. For instance, in the city of New London the population has increased since 1914 at least 30 per cent., while the consumption has increased but 3 per cent., due to an increased installation of meters and to inspection of fixtures.

Yours truly,

(Signed) W. H. RICHARDS.

THE PRESIDENT. What is it your pleasure to do with the communication? I suppose it carries a recommendation that the resolution that was adopted last September be sent to the mayor or executive officer of each city represented in this Association. When Mr. Diven was recently in Washington he had a very interesting talk with the Fuel Administration, and they outlined to him a certain campaign that they proposed to inaugurate; and while of course that would apply particularly to coal, it might very likely cover Mr. Richards' ideas, because it could be made all-embracing to cover those cases where it is necessary to save water for munition purposes. Perhaps Mr. Diven will outline the conversation he had in Washington.

MR. J. M. DIVEN. Mr. President, the movement has only just started, and the appointment was made yesterday of a man to take charge of it, — that is, an educational campaign for the saving of water, particularly with the view of saving coal, very much on the lines of the educational plan for the conservation of food, although the idea is to go even further than that. For instance, in our talk it was estimated that the coal consumed in

pumping water for the ornamental fountains in the city of Washington, of which, as you all know, there are a great many, every day in the year, would supply five families for a year, or fifteen hundred or more families for a day, with coal that is now wasted to supply the ornamental fountains. And the same proposition applies to lawn sprinklers, which use a great deal of water; and it is possible that next year, when the coal situation may be worse than it has been this year, or even if it is as bad as it is now, an order may be issued to prohibit the use of lawn sprinklers, where coal is used for pumping, or where electricity generated by coal is used, or even where hydro-electric power is used, on the theory that that power might take the place of coal in some other plant. As you know, the Administration has authority to enforce these things; and there is very much hope that the diminution of water waste will run way beyond the war and that we will all be benefited very largely by it in the future.

Mr. Richards suggests the sending of this resolution to the mayors of cities represented in the Association in New England, — but why confine it to New England? We have members all over the country. I think we had better amend the Resolution, if it be considered as a Resolution, so that it shall be sent to all cities represented in the Association, whether located in New England or elsewhere.

Mr. Sherman. There is another point in Mr. Richards' letter that has not been touched upon, and perhaps he did not make it as strong as he might have in the letter, and that is that many communities having inadequate supplies are facing an early necessity of obtaining of additional supplies at large capital expenditure unless the consumption is kept down. And in view of the Government's recommendation that capital expenditures be limited and investments be kept down to the lowest possible amount for actual necessities, it would be desirable to make sure that a real necessity existed, that is, that there was a shortage of supply not due to wastage of water but to actual growth in the reasonable consumption, before a bond issue ought to be allowed for an extension of the plant. A comparatively small sum spent in maintenance, inspection, repairs, and installation of meters would often make unnecessary a large capital expenditure and bond issue for the installation of a supply.

The motion which Mr. Richards made and which was adopted was this: "I move that it is the sense of this Association that any public work, except that for life and health, be deferred until conditions change." If it was sent out in that form it would be susceptible of a good many different interpretations, I think.

Perhaps it would not be out of place to read what Mr. Richards said in presenting the matter, and then, if it is the sense of the meeting that something along this line should be done, it might be well to instruct the Executive Committee, or some special committee, to draft a resolution or statement embodying the sense of the discussion and of this motion. Mr. Richards said:

"In a recent editorial in a paper devoted to advertising construction work and tools, the endeavor is made to prove that it is desirable to proceed with municipal construction work regardless of abnormal costs and abnormal conditions; indeed, the existence of these conditions is denied. These conditions are well known to any member of this Association who has undertaken construction work during the past year, whether by contract or by day labor, so that it is only necessary to state them briefly.

"A large proportion of the day labor of this country is done by aliens or near aliens, a large portion of whom have now left this country to fight the battles of their own countries. Naturally they are the most efficient ones who have gone. Thus, while the cost of labor, due to scarcity, has advanced about 40 per cent., the efficiency has declined until the actual value of labor has been reduced at least 50 per cent., and this condition is likely to be exaggerated by the demand for men for our own armies.

"The materials and tools which are required for construction have increased from two to three times in cost over that of years ago. It is, then, safe to say that the cost of any new construction has doubled in two years and is now double the normal or real value. Whether construction at this time is paid for at once or by bonds or securities to be paid by posterity, the investment is twice its normal value. Would any careful business man make an investment without knowing that the future receipts would warrant the expenditure? It would seem that all new work, except that immediately demanded for the preservation of life and health, should be deferred until normal conditions are restored, for economic reasons.

"But there is another reason: this country is at war, — your country, my country, is in jeopardy. Every dollar, every bit of energy, all the skill and efficiency should be devoted to saving it from destruction, and until that is accomplished nothing else matters. If a camp needs a water supply, build it and charge it up to profit and loss; but do not build anything that can be deferred until the future."

MR. DIVEN. If a resolution is to be adopted, wouldn't it be well to ask Mr. Richards to word it in proper form? But, on the other hand, hasn't this matter been taken care of already? There is a Government order forbidding the issue of bonds except upon approval by the Government; and, more than that, the price of materials is almost prohibitive and we couldn't get them if we wanted them. However, I think that it would be well for us to pass some resolution, so I suggest that it might be well for Mr. Richards to put it in proper shape, elaborating it a little more.

On motion of Mr. George A. King it was voted that Mr. Richards' letter be referred to the Executive Committee with power to take such action as seems desirable.

REPORT OF PRIORITIES COMMITTEE.

THE PRESIDENT. The next matter on the program is "Report of Priorities Committee," Willard Kent, chairman. In Mr. Kent's absence, I, perhaps, may make a statement, and that is that there is no report of the Priorities Committee ready at this time, because the committee has not been able to meet. The situation at Washington has been such that no application for general priority would be considered. Specific cases would be taken up, but no general priority, for instance, as in the case of meters or any other broad line like that, or water works as a whole, would be granted. And in the new priority order that has just been issued, published in the papers day before yesterday, you will notice that water companies and water works are in Class 2. Possibly it may hurt our pride a little to think that food is in Class 1 and water is in Class 2, — because we all know that water is very much more important than food, — and that hospitals and sanatoriums are in Class 1 while water companies are in Class 2, — and yet what hospital or sanatorium could operate if the water works are not kept up?

But you read a little further in the report which goes with this publication and you will see that one of the fundamental principles governing the establishment of this list was the need of stimulating production. I suppose the food industries really do need to be stimulated more than water-works people. I think we all understand that we need to be curtailed rather than stimulated

in our production, if possible; and, of course, we understand the necessity of stimulating food production in this country, not only for ourselves but for our allies.

I had some further curiosity to notice, as possibly you noticed, that copper and brass works are in Class 3 or Class 4. It is a curious study how it works out, because, while we are in Class 2, the very essentials we depend upon for our operation are in Class 3 and Class 4.

I think there is no question that the Priorities Committee should be continued, and the suggestion has been made that the committee should be enlarged by the addition of one or two members representative of the manufacturers. There are now three active members on the committee, the Secretary, Mr. Martin, and Mr. Miller, and I personally believe that the committee could work a good deal more effectively if there were representatives from our associate members, the manufacturers, on it. What would be the thought of the Association as to continuing the Priorities Committee and enlarging it to include two manufacturers or their representatives?

MR. DIVEN. I make that motion, Mr. President.

THE PRESIDENT. Would you make any suggestion as to what interests should be represented?

MR. DIVEN. Of course coal is our principal need; but I would suggest a representative of the meter manufacturers, above all. And I think that the Fuel Administration will take up that matter and try to secure priority for materials for manufacturing meters, and for the shipment of meters, because the Fuel Administration is going to advocate pretty strongly the use of meters to cut down waste. Outside of meter manufacturers and the coal I would suggest the pumping plants, and especially repair parts.

THE PRESIDENT. The repair-parts question is one I think this Priority Committee will have to take up. I haven't yet been able to convince the Priority Board that an emergency repair is in a class by itself.

The motion that the Priorities Committee be continued and enlarged by adding two representatives of the manufacturers was adopted.

Committee to Nominate Officers.

On motion of Mr. William F. Sullivan, the President was authorized to appoint a nominating committee of five to nominate officers for the ensuing year.

The President appointed as the committee Charles W. Sherman, George W. Batchelder, J. W. Kay, Bertram Brewer, and F. A. McInnes.

Mr. Henry A. Symonds read a report submitted by Mr. George A. Carpenter on the subject of the "Intimate Connection between the Saving of Water and the Conservation of Coal." The paper was discussed by Mr. Charles W. Sherman, the President, and Mr. J. M. Diven.

Mr. F. J. Gifford presented the report of the Special Committee on Frozen Water Pipes. Mr. Frank A. McInnes, a member of the committee, and Mr. Caleb M. Saville discussed the subject.

Adjourned to 2 P.M.

Afternoon Session.

The first matter on the program for the afternoon session was an address on "The Fuel Situation in New England," by James J. Storrow, Fuel Administrator for New England. In the absence of Mr. Storrow, who had been obliged to go to Washington, Prof. Ira A. Hollis, the engineer of the New England Fuel Administration, made an address on the subject which had been assigned to Mr. Storrow.

President Davis read a telegram from Edward E. Minor, superintendent, New Haven, calling attention to the fact that water works had been placed in the second class in the Priority List, and asking that some action be taken by the Association to secure a reclassification.

President Davis. We miss to-day one of our active members, Mr. Coggeshall, of New Bedford, who has been very critically ill, but who we now hear is on the road to recovery. I think it would be a very happy thing if some resolution could be adopted at this time conveying our kindest remembrances to Mr. Coggeshall and expressing our hope for his speedy complete recovery. Will anybody make a motion to that effect?

Mr. J. M. Diven. Being perhaps the next oldest water-works man to Mr. Coggeshall in the Association, I will take great pleasure in offering such a resolution.

President Davis. I suppose that carries with it the provision that Mr. Diven will draw up the resolution that the Association will send, and I will put the motion in that way.

The motion was adopted.

Major Charles R. Gow, construction quartermaster, Boston, gave a description of the Quartermaster's Terminal at Boston required for war work.

Thomas C. Atwood, resident supervising engineer, described the construction of the Squantum Destroyer Plant.

The session was brought to a close by an address by Prof. William T. Sedgwick, Past-President of the New England Water Works Association, chairman of the Massachusetts Division of the National Security League, entitled, "From Peace to War, from War to Victory, from Victory to Judgment."

Adjourned.

Morning Session, Thursday, September 12, 1918.

President Davis in the chair.

The Secretary read the following list of applications for membership, duly approved by the Executive Committee:

J. W. Gummo, Watervliet, N. Y., resident engineer and superintendent of water supply for the city of Watervliet; Roswell M. Roper, East Orange, N. J., member New Jersey Inland Waterways, U. S. Government Inland Waterways, and East Orange, N. J., Water Works; George E. Gormley, Abington, Mass., water commissioner. — 3.

On motion of Mr. J. M. Diven, the Secretary was instructed to cast the ballot of the Association in favor of the applicants named, and he having done so, they were declared elected members of the Association.

Mr. Davis A. Heffernan, superintendent of water works, Milton, Mass., read a paper entitled, "Practical Methods for Detecting Leaks in Underground Pipes." President Carleton E. Davis, Mr. J. M. Diven, Mr. George F. Merrill, Mr. A. E. Martin, Mr. William Naylor, Mr. Frank J. Gifford, Mr. George E. Gormley,

Mr. H. D. Gedley, Mr. Samuel A. Agnew took part in the discussion.

For the benefit of those members who were not present at the meeting on Wednesday, September 11, Mr. Frank J. Gifford gave a résumé of the report of Committee on Frozen Water Pipes, discussion of this subject being resumed and participated in by Mr. George F. Merrill, Mr. J. M. Diven, and Mr. Thomas E. Lally.

Report of Committee on Uniform Accounting.

Mr. A. R. Hathaway. Mr. Sawyer, the chairman of our committee, could not be here to-day. He was here yesterday and we had a little conference, and he wished me to say a few words this morning. This subject is a very important one, and while we cannot afford what we would like, — as a committee we have been unable to get together formally, — but there has been some discussion informally among some of the members, and I hope that you will allow us to continue and we may work out something or other later on. The status of the committee and the work that it has not accomplished, I was thinking in my own mind, is expressed somewhat by a little incident I heard of, where there was a show in a town and a rain had come up, and the stage manager had to come out in front of the stage and address an empty house. He said, " Ladies and Gentlemen: As there is no one here I will dismiss you all; the performance of the evening will not be performed but will be repeated to-morrow evening." [*Laughter.*] I hope, as an attempt to keep the show alive, that you will allow this committee to still live.

President Davis. I think there is no question that the Association ought to continue that committee. It is altogether too good a committee and working on too important a matter to let the subject drop. Apparently no motion is necessary, so that I will state that the committee is continued.

Report of Committee on Standard Specifications on Water Meters.

Mr. Charles W. Sherman. Mr. President, the committee reports progress. We had thought of reporting a tentative draft — perhaps it would be too much to call them specifications — but

of certain suggestions which might be submitted to the meeting for discussion. But as it did not prove practicable for us to discuss these matters with the manufacturers, and as it appeared through communication with one or two of them that if we presented this and started a discussion on it we might be barking up the wrong tree, we thought it would be better to report only that we had made a little progress. The committee has not been able to meet in session and has done whatever it has done by correspondence.

PRESIDENT DAVIS. Then that committee will be continued.

REGARDING PRIORITIES COMMITTEE.

PRESIDENT DAVIS. Yesterday the Association voted to continue the Committee on Priorities and increase its membership by two representatives from the members of the manufacturers, and those additional members will be Mr. Seth D. Higley and Mr. William Woodburn. That leaves the membership of the Priorities Committee, Mr. Willard Kent, Mr. A. E. Martin, Mr. H. A. Miller, Mr. Seth D. Higley, and Mr. William Woodburn.

In that connection there was some little discussion yesterday about the desirability of protesting to the Priorities Board in Washington against the inclusion of water companies and water works in Class 2 rather than in Class 1. The suggestion was made by Mr. Minor yesterday, in the telegram which I read, that the Association should go on record by a protest to Mr. Baruch asking that he reconsider the matter. The subject was discussed somewhat this morning in the Executive Committee, and it seemed to be the conclusion of the Executive Committee that it was best not to make a protest from the Association as a whole but leave the matter to this Priorities Committee. I feel very strongly that that is the proper attitude to take, — that it might perhaps be even worse than useless to protest as an Association, that it might put us in a wrong position with the Priorities Board and perhaps prejudice our case in the future on any particular points that we might want to bring up for their consideration, — and accept what the Priorities Board has put out as being their best judgment at the present time. As was suggested yesterday, we feel that we are just as important, or perhaps more important,

than food. But I believe, and I think most of you will agree with me, that there will be absolutely no question about water works getting the necessary coal in any event. I am constrained to tell you a story that I told the Executive Committee this morning, illustrating my viewpoint on the matter. It is a very old story, and perhaps old enough to be new. There was a church organist one time giving a very beautiful piece, and after the conclusion the small boy who had been pumping the organ in the rear came out and said to the organist, — "That was a magnificent piece we gave, wasn't it?" And the organist said, "You little devil, what did you have to do with it? You go back and pump the organ." So the boy went back, and the organist was giving another piece, and just as he came to the most thrilling crescendo of the whole thing the boy stopped pumping and the music ended up in a screech. Then the boy came out and said, "Well, you found out I had something to do with that, after all." And it is the same situation with our pumping stations; if they quit giving us coal they will soon find out that we have a good deal to do with running the country at the present time; and if it comes to a question of even munitions plants or food factories as against the water supply I feel perfectly confident that we will get all the coal we need to run our pumping stations when it comes to a show-down. I believe that it is so absolutely true that we would be simply wasting our time and perhaps prejudicing our cause if we made a protest now, because they all know this: that we are the only universal, fundamental, absolute necessity in the whole country. So that the Executive Committee felt it best not to make any formal protest, and unless there is some different feeling on the floor I think we will consider that that stands.

Adjourned.

Afternoon Session.

The Secretary read the application for membership, approved by the Executive Committee, of Winthrop T. Noyes, Greenfield, Mass., member Board Water Commissioners.

On motion of Mr. Frank L. Fuller, the Secretary was instructed to cast the ballot of the Association in favor of the applicant named, and he having done so, the applicant was declared to be elected a member of the Association.

MR. A. E. MARTIN. A number of the members have expressed to me personally — and I presume they have talked it over amongst themselves besides — their appreciation of the address which Professor Sedgwick gave us yesterday, and quite a few have suggested that undoubtedly each member of the Association would like to have a copy of the address in his possession. The Association spreads over a good deal of country, and it might be well if a copy of this address could be put into the hands of each member so that he might have it published in his local newspaper as something coming from this Association. I make a motion, therefore, that that address be published ahead of the issue of the Proceedings and of the JOURNAL and mailed to the members of this Association.

The motion was seconded by Mr. Frank L. Fuller.

PRESIDENT DAVIS. Does anybody have anything to say about that motion which has been made and seconded, — that Professor Sedgwick's paper be printed in advance of the JOURNAL and distributed to all the membership? It seems to me that is a most admirable suggestion because that paper was very well worth wide distribution. If there is no discussion we will have a vote.

The question was put and the motion carried.

Mr. Charles T. Main, mill engineer, Boston, read a paper entitled, " The Fuel Situation in New England, and Necessity of Careful Planning in Order to Get Through the Year on a Restricted Amount." President Carleton E. Davis, Mr. J. M. Diven, Mr. Frank L. Fuller, Mr. George A. Stacy, and Mr. John J. Moore took part in the discussion.

Mr. John J. Moore, consulting engineer, Boston, read a paper entitled, " Expediency of Raising Water Rates to Offset Increased Costs." The discussion was participated in by President Carleton E. Davis, Mr. Frank L. Fuller, Mr. Charles W. Sherman, Mr. J. M. Diven, Mr. Hugh McLean, Mr. Henry A. Symonds, and Mr. Samuel A. Agnew.

An informal discussion was had on the subject of " Experience in Labor Troubles." This was participated in by President Carleton E. Davis, Mr. Frank L. Fuller, Mr. Bertram Brewer, Mr. H. V. Macksey, Mr. J. M. Diven, Mr. A. E. Martin, Mr. Patrick Gear, and others.

Adjourned.

EXECUTIVE COMMITTEE.

Meeting of the Executive Committee of the New England Water Works Association, Boston Harbor, June 19, 1918.

At a meeting of the Executive Committee of the New England Water Works Association, held this day on the boat of the Nantasket Beach Steamboat Company en route to Pemberton, there were present Samuel E. Killam, Frank J. Gifford, A. R. Hathaway, Lewis M. Bancroft, Henry V. Macksey, and Willard Kent.

Three applications for membership were received, viz.: H. J. Carroll, Rumford, Me.; LeRoy M. Peterson, superintendent Duxbury Fire and Water District, Millbrook, Mass., and James W. Routh, chief engineer, Rochester Bureau of Municipal Research, Rochester, N. Y.

Discussion was held on the subject of Annual Convention, and it was the opinion of the majority of those present that it should be omitted.

Adjourned.

Attest,

WILLARD KENT, *Secretary.*

Meeting of the Executive Committee of the New England Water Works Association at headquarters, Tremont Temple, Boston, Mass., July 10, 1918, pursuant to call of the President.

Present: President Carleton E. Davis, and members Samuel E. Killam, Henry V. Macksey, Frank A. Barbour, Thomas McKenzie, Henry A. Symonds, Lewis M. Bancroft, and Willard Kent.

On motion of Mr. McKenzie, seconded by Mr. Barbour, it was voted: That the Association hold a business meeting of two days' duration at Tremont Temple, Boston, Mass., September 11 and 12, 1918.

Mr. George A. Carpenter was appointed a committee to look into the subject of "The Intimate Relation between the Saving of Water and the Conservation of Coal."

President Carleton E. Davis was, by unanimous vote, appointed a committee to issue, in behalf of the Association, a circular and poster in relation to the conservation of water.

Adjourned.

Attest,

WILLARD KENT, *Secretary.*

Meeting of the Executive Committee of the New England Water Works Association at headquarters, Tremont Temple, Boston, Mass., September 11, 1918.

Present: President Carleton E. Davis, Samuel E. Killam, Frank J. Gifford, A. R. Hathaway, Henry A. Symonds, L. M. Bancroft, and by invitation, Charles W. Sherman, who acted as Secretary *pro tem.*

Three applications for membership were received and unanimously recommended therefor, viz., Henry F. Beal, superintendent water works, Waltham, Mass.; Frank A. Mazzur, Waban, Mass., and Isaac S. Walker, general manager New Chester Water Company, Frankford, Philadelphia, Pa.

The report of the Committee on Award of Dexter Brackett Memorial Medal was read and referred to a committee consisting of the Board of Editors and Charles W. Sherman.

Adjourned.

CHARLES W. SHERMAN, *Secretary pro tem*

Meeting of the Executive Committee of the New England Water Works Association at headquarters, Tremont Temple, Boston, Mass., September 12, 1918.

Present: President Carleton E. Davis, Samuel E. Killam, Henry V. Macksey, Thomas McKenzie, Frank J. Gifford, A. R. Hathaway, Henry A. Symonds, Lewis M. Bancroft, and Willard Kent.

Four applications for membership were presented and the applicants were by unanimous vote recommended therefor, viz., Winthrop T. Noyes, water commissioner, Greenfield, Mass.;

J. W. Gummo, superintendent water works, Watervliet, N. Y.; Roswell M. Roper, superintendent water works, East Orange, N. J.; George E. Gormley, water commissioner, Abington, Mass.

Willard Kent, Samuel E. Killam, and Frank J. Gifford were, by vote, constituted a committee to arrange for hotel accommodations for the winter meetings of the Association.

The action of the Secretary in returning to Mrs. Maybury the dues of William E. Maybury received subsequent to his death was approved.

Adjourned.

Attest,

WILLARD KENT, *Secretary.*

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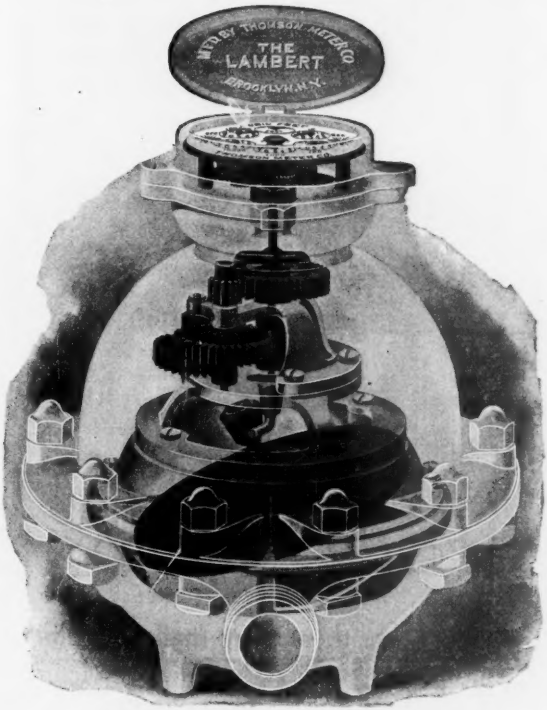

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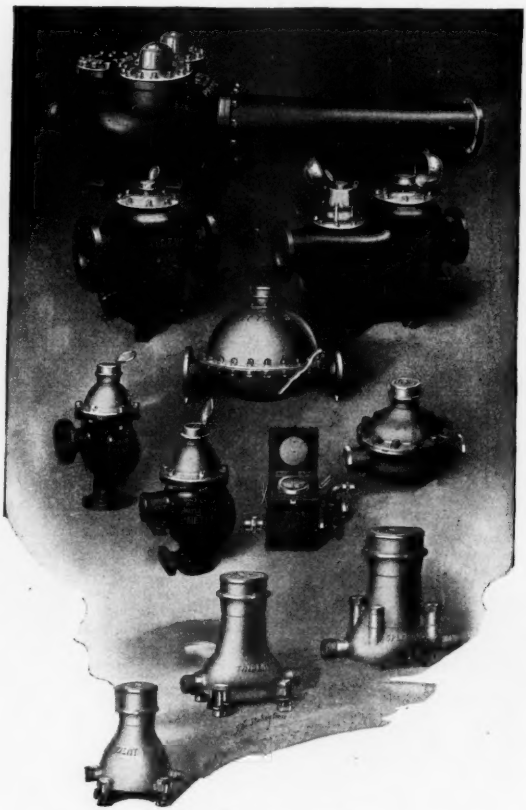

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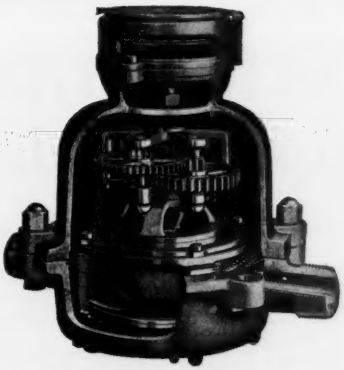

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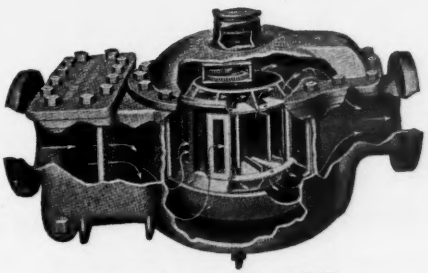

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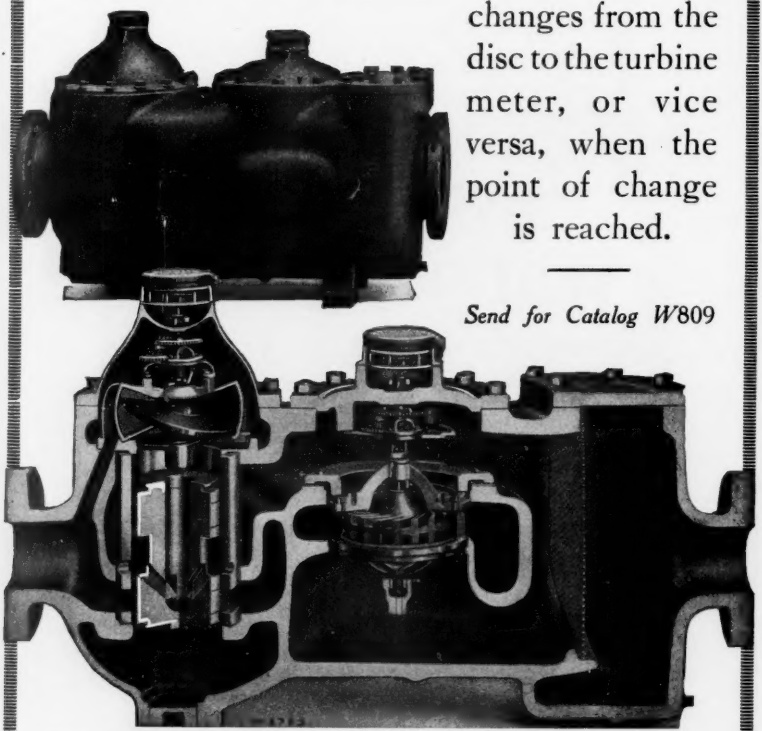

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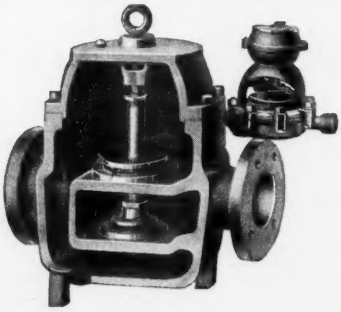

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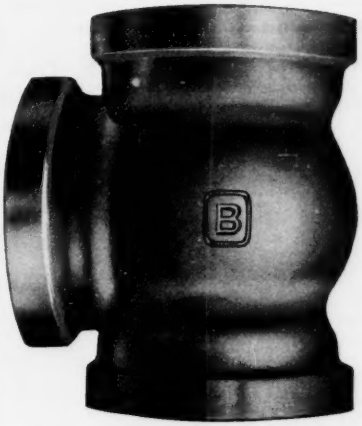

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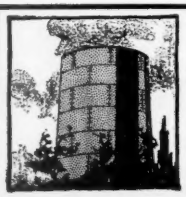

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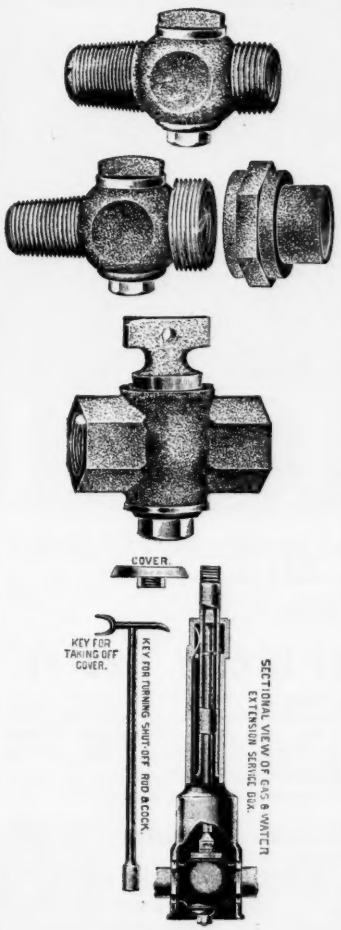

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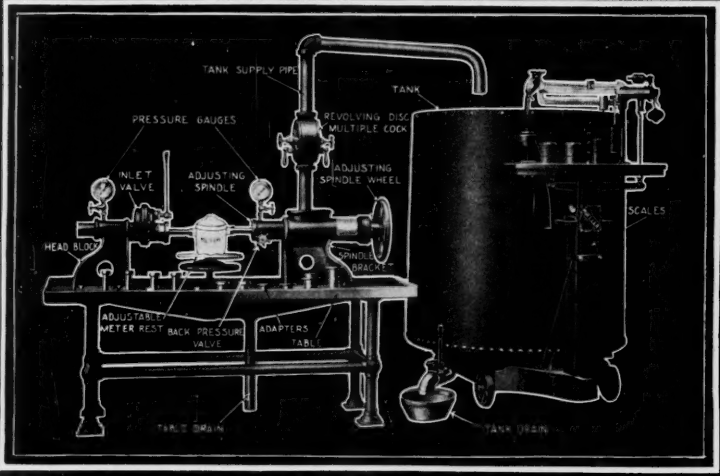

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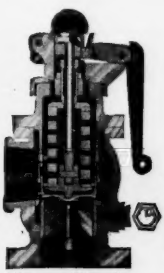

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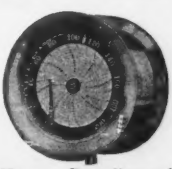

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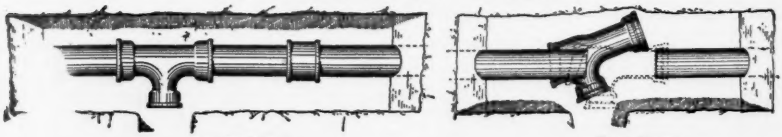

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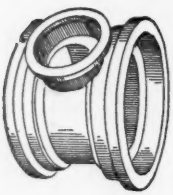

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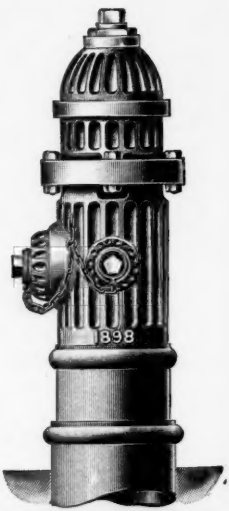

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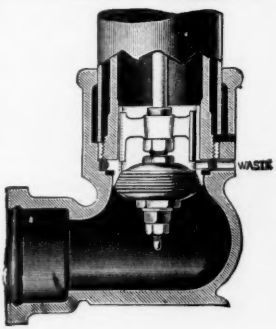

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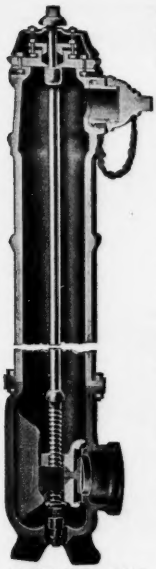

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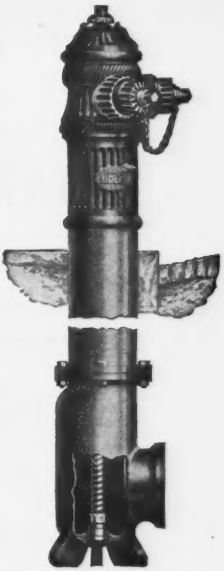

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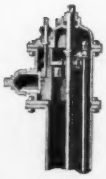
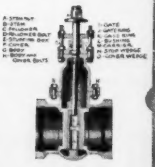
Section of Taper Seat Valve.



Hydrant with Independent Nozzle Cut-off.



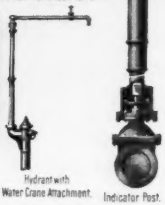
Section of Parallel Seat Valve.

Section of Vertical Check Valve.

Section of Vertical Foot Valve.

Horizontal Check Valve.

Vertical Foot Valve.



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Also Flange Pipe, Street Castings,
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Such is the latest story of Cast-Iron Pipe efficiency — and the efficiency of the good, old-fashioned bell-and-spigot joint.

There were 2,500 joints, and out of all that multitude only three showed slight signs of leakage when the line was tested.

At one point the line dipped through a lake, dropped 20 feet under water, then rose to the shore on the other side. The lake was narrow, — we'll show you a picture of that later, — so you can imagine the tremendous strain to which those joints were subjected. With that in mind just recall that only three joints out of 2,500 showed even a slight leak. Some 2,497 joints perfect, in spite of the rocky-road-to-Dublin conditions almost everywhere.

Where was it? Medicine Canyon, Okla. What pipe was it? The pipe with 250 years' service record back of it, —

24" Line looking South from Dam through Medicine Canyon.

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For overhead joints, or in wet places where the use of molten lead is not only impracticable, but dangerous — **LEAD WOOL** may be employed to advantage. It makes perfectly tight joints to withstand the highest pressures, yet sufficiently elastic to admit of considerable sagging or settling of the pipe without causing the joint to leak. The difference in this respect, as compared with the poured joint, is notable.

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Highest quality Lead Lined Iron Pipe and Fittings

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YOU SHOULD USE

Trade "LEADITE" Mark

Registered U. S. Patent Office

FOR

Jointing Water Mains

1. **DURABILITY.** Leadite joints increase in strength with age.
2. **NO CAULKING.** Leadite joints require no caulking, because the Leadite adheres to the pipe, making a water-tight bond.
3. **COMPARATIVE QUANTITIES.** One ton of Leadite is equivalent to four tons of lead.
4. **LABOR SAVING.** Saves caulking charges and digging of large bell-holes, and reduces the cost of trench pumping to the minimum.
5. **COST.** Its use saves 50 to 65 per cent. over lead, owing to the saving effected in material and labor.
6. **TOOLS.** As no caulking is required, fewer tools are needed.
7. **TRANSPORTATION.** Considerable freight charges are saved because Leadite is lighter than lead.
8. **HAULING.** Saves hauling expense on the work because you move only one fourth the weight of jointing material.
9. **FUEL.** Saves fuel because you melt only one ton of material instead of four, and not as much heat is required either.
10. **DELIVERY.** We can make prompt shipments.
11. **DAMAGE SUITS.** Claims for damages caused by joints blowing out are prevented because Leadite joints will not blow out under any pressure.
12. **USERS.** Progressive water works all over the country use Leadite.

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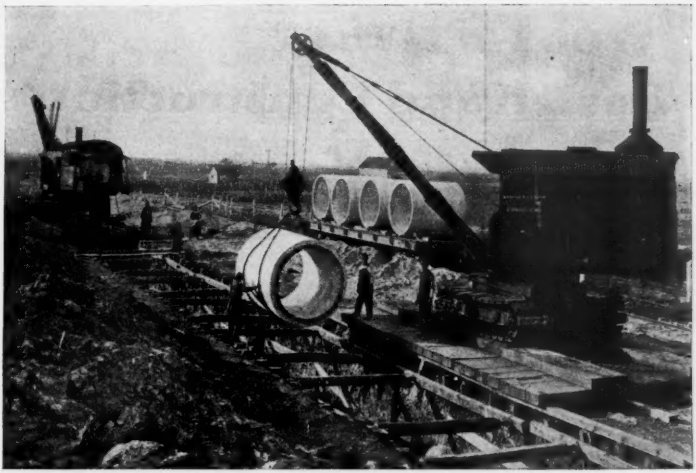

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Length, 10 miles.

Heads, 45 to 90 feet.

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Manufacturers of

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Paints for all purposes

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Michigan Pipe Co. . . . Back cover

New England Water Works Association,

ORGANIZED JUNE 12, 1882.

APPLICATION FOR MEMBERSHIP.

I, the undersigned, residing at .....

..... *being desirous of admission into the New England Water Works Association, hereby make application for* .....

(resident, non-resident or associate)

.....*membership.*

I am .....*years of age, and I have been engaged in the following named work:*

.....

.....

.....

I will conform to the requirements of membership if elected

Signed, ...

Address, ...

Dated, ...*191*

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